SR 347/SR 84 CORRIDOR PROFILE STUDY

SR 347: I-10 TO SR 84
SR 84: SR 347 TO I-8

ADOT WORK TASK NO. MPD-0041-17
ADOT CONTRACT NO. 18-177731

DRAFT REPORT: PERFORMANCE AND NEEDS EVALUATION

AUGUST 2017

PREPARED FOR:

ARIZONA DEPARTMENT OF TRANSPORTATION

PREPARED BY:

This report was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, and for the use or adaptation of previously published material, presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration, U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names that may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. government and the State of Arizona do not endorse products or manufacturers.

Table of Contents

List of Figures

List of Tables

Appendices

ACRONYMS & ABBREVIATIONS

AADT	Average Annual Daily Traffic
ABISS	Arizona Bridge Information and Storage System
ADOT	Arizona Department of Transportation
AGFD	Arizona Game and Fish Department
ASLD	Arizona State Land Department
AZTDM	Arizona Statewide Travel Demand Model
BLM	Bureau of Land Management
BQAZ	Building a Quality Arizona
CAG	Central Arizona Governments
CCTV	Closed Circuit Television
CR	Cracking Rating
DCR	Design Concept Report
DMS	Dynamic Message Sign
FHWA	Federal Highway Administration
FY	Fiscal Year
HCRS	Highway Condition Reporting System
HERE	Real time traffic conditions database produced by American Digital Cartography Inc.
HPMS	Highway Performance Monitoring System
I-	Interstate
IRI	International Roughness Index
ITS	Intelligent Transportation System
LCCA	Life-Cycle Cost Analysis
LOS	Level of Service
LRTP	Long-Range Transportation Plan
MAG	Maricopa Association of Governments
MAP-21	Moving Ahead for Progress in the 21st Century
MP	Milepost
MPD	Multimodal Planning Division
NB	Northbound
NPV	Net Present Value
OP	Overpass
P2P	Planning-to-Programming
PA	Project Assessment
PARA	Planning Assistance for Rural Areas
PDI	Pavement Distress Index
PES	Performance Effectiveness Score
PSR	Pavement Serviceability Rating
PTI	Planning Time Index
RTP	Regional Transportation Plan
RWIS	Road Weather Information System
SATS	Small Area Transportation Study
SB	Southbound
SERI	Species of Economic and Recreational Importance
SHSP	Strategic Highway Safety Plan
SOV	Single Occupancy Vehicle
SR	State Route
TAC	Technical Advisory Committee
TI	Traffic Interchange
TIP	Transportation Improvement Plan
TPTI	Truck Planning Time Index
TTI	Travel Time Index
TTTI	Truck Travel Time Index
UP	Underpass
USDOT	United States Department of Transportation
V/C	Volume-to-Capacity Ratio
VMT	Vehicle-Miles Travelled
WIM	Weigh-in-Motion

1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 347 (SR 347) from Interstate 10 (I-10) to State Route 84 (SR 84) and SR 84 from SR 347 to Interstate 8 (I-8). The study examines key performance measures relative to the SR 347/SR 84 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT has already conducted eleven CPS within three separate groupings or rounds.

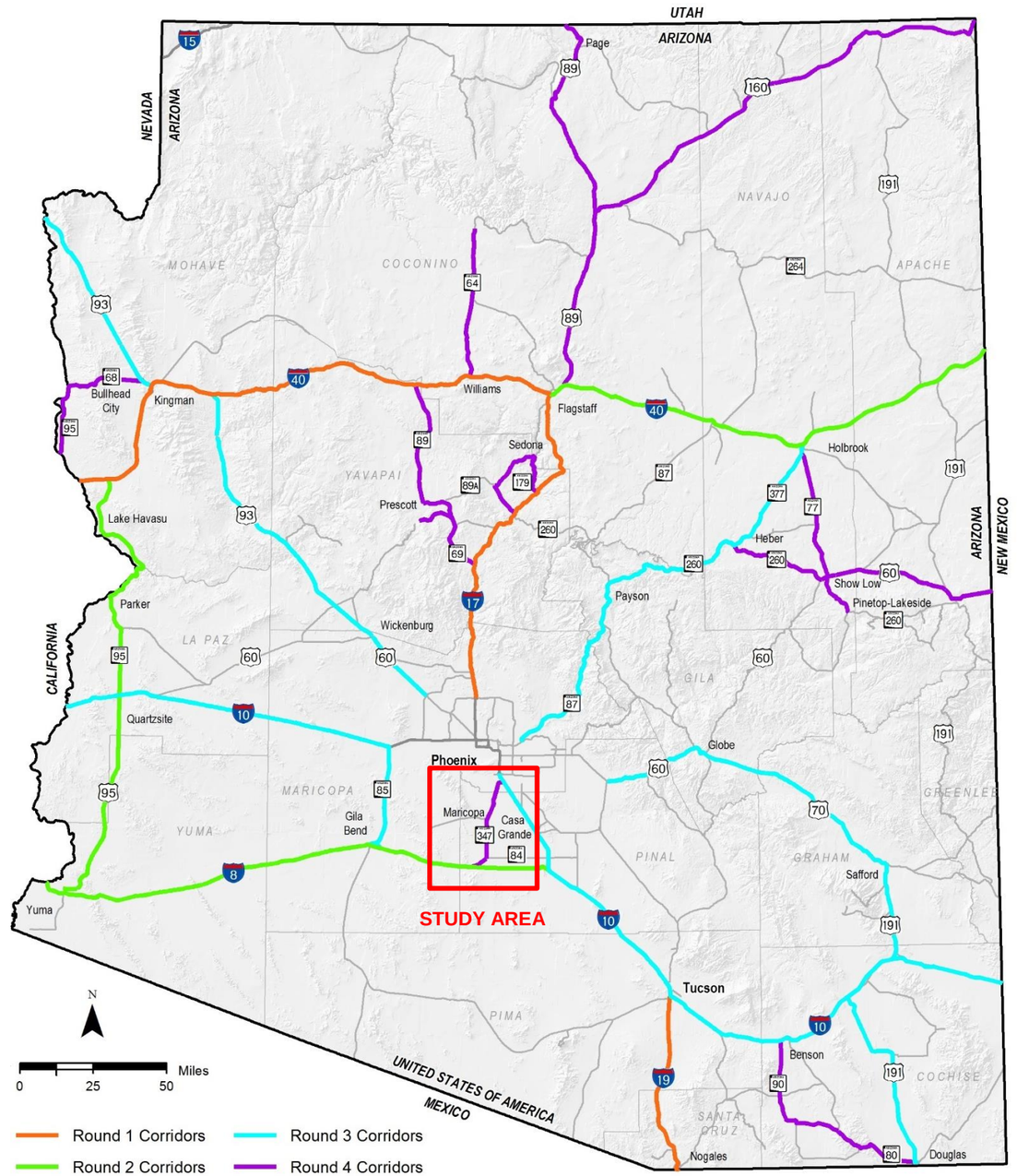
The fourth round (Round 4) of studies began in Spring 2017, and includes:

- SR 69/SR 89: I-17 to I-40
- US 89: I-40 to Utah State Line
- SR 64: I-40 to Grand Canyon National Park
- SR 179/SR 89A/SR 260: I-17 (Camp Verde) to I-17 (Montezuma Well Road)
- SR 347/SR 84: I-10 to I-8
- SR 260: SR 277 to SR 73; US 60: SR 260 to New Mexico State Line
- SR 77: US 60 to SR 377
- SR 68/SR 95: US 93 to California State Line
- US 160: US 89 to New Mexico State Line
- SR 90/SR 80: I-10 to US 191

The studies under this program assess the overall health, or performance, of the state's strategic highways. The CPS will identify candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

The SR 347/SR 84 corridor, depicted in **Figure 1** along with the previous three rounds corridors, is one of the strategic statewide corridors identified and the subject of this Round 4 CPS.

Figure 1: Corridor Study Area



1.1 Corridor Study Purpose

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation, accounting for performance effectiveness and risk analysis findings

1.2 Study Goals and Objectives

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 347/SR 84 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits can be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extending asset service life
- Modernization: Highway improvements that upgrade efficiency, functionality, and safety without adding capacity
- Expansion: Improvements that add transportation capacity through the addition of new facilities and/or services

This study identifies potential actions to improve the performance of the SR 347/SR 84 corridor. Proposed actions are compared based on their likelihood of achieving desired performance levels, life-cycle costs, cost-effectiveness, and risk analysis to produce a prioritized list of solutions that help achieve corridor goals.

The following goals are identified as the desired outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Corridor Overview and Location

The SR 347/SR 84 corridor between I-10 and I-8 provides movement for agricultural, freight, commuting, recreation needs, and regional travel within Arizona. It provides a key link between the southern portion of the Phoenix metropolitan area and the southern region of the state and serves intrastate, interstate, and international commerce. The corridor connects the City of Maricopa, the Ak-Chin Indian Community, and the Gila River Indian Community (GRIC). This corridor also serves recreational areas within and near the Sonoran Desert National Monument via SR 238 and I-8. The SR 347/SR 84 corridor includes all of SR 347 and a small portion of SR 84. The SR 347/SR 84 corridor between I-10 and I-8 is approximately 34 miles in length.

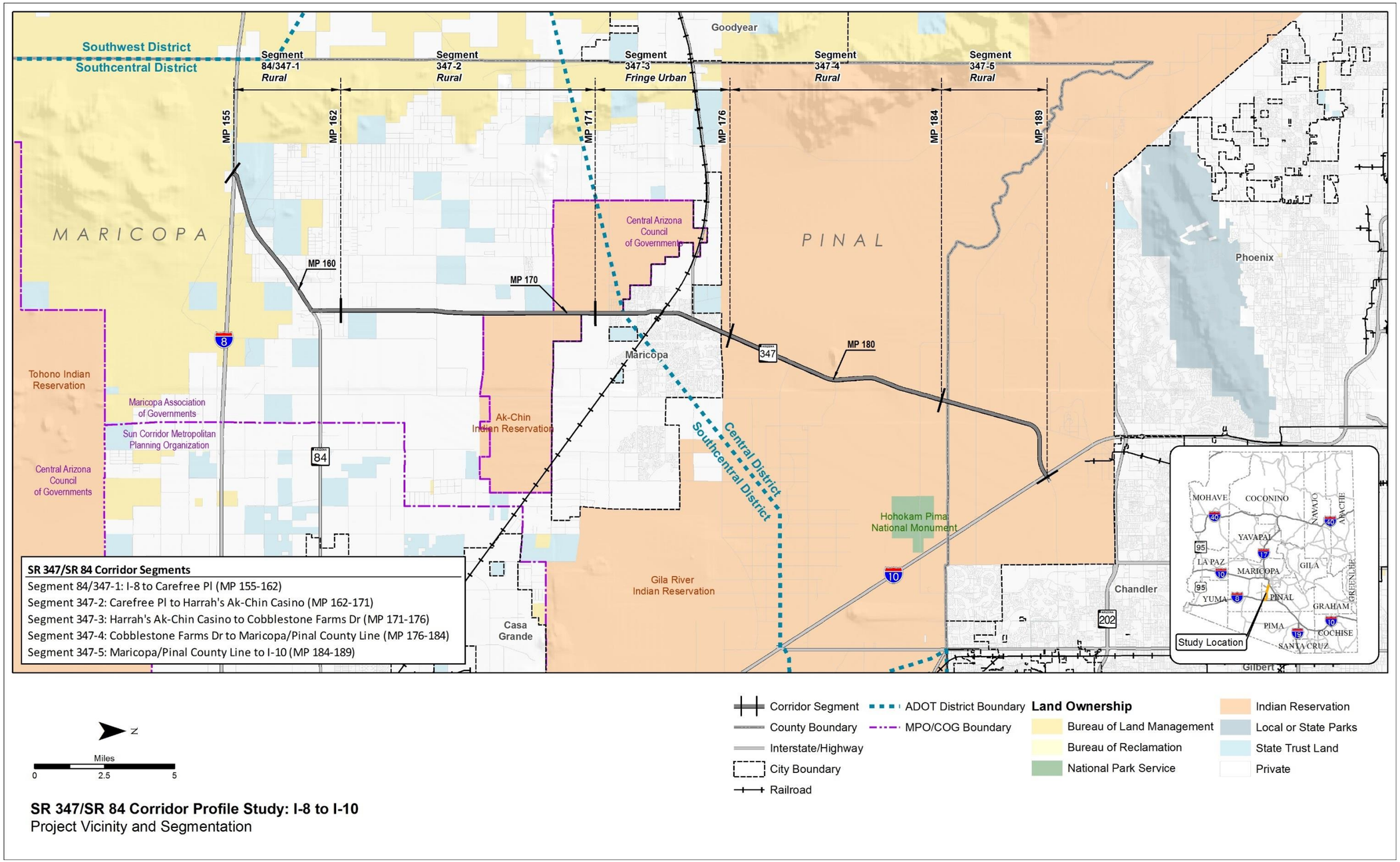
1.4 Corridor Segments

The SR 347/SR 84 corridor is divided into 5 planning segments to allow for an appropriate level of detailed needs analysis, performance evaluation, and comparison between different segments of the corridor. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are described in **Table 1** and shown in **Figure 2**.

Table 1: SR 347/SR 84 Corridor Segments

Segment #	Route	Begin	End	Approx. Begin Milepost	Approx. End Milepost	Approx. Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2015/2035 Average Annual Daily Traffic Volume (vpd)	Character Description
84/347-1	SR 84/ SR 347	I-8	Carefree Place	155	162	7	1,1	1,000/2,000	This rural segment has uninterrupted flow (except for the southbound SR 347 movement at SR 84, consistent topography, and is comprised of a two-lane undivided section.
347-2	SR 347	Carefree Place	Harrah's Ak-Chin Casino	162	171	9	2,2	6,000/10,000	This rural segment has uninterrupted flow, consistent topography, and is comprised of a four-lane divided section.
347-3	SR 347	Harrah's Ak-Chin Casino	Cobblestone Farms Drive	171	176	5	2,2 3,3	26,000/44,000	This fringe urban segment has interrupted flow due to many traffic signals and an at-grade railroad crossing, consistent topography, numerous access points, and is comprised of four/five/six-lane divided sections.
347-4	SR 347	Cobblestone Farms Drive	Maricopa/Pinal County Line	176	184	8	2,2	40,000/68,000	This rural segment has interrupted flow, consistent topography and traffic volumes, and is comprised of a four-lane divided section. There are two traffic signals located in this segment, at Casa Blanca Rd and at the Gila River Sand and Gravel Maricopa Plant entrance.
347-5	SR 347	Maricopa/Pinal County Line	I-10	184	189	5	2,2	36,000/63,000	This rural segment has interrupted flow, consistent topography and traffic volumes, and is comprised of a four-lane divided section. There are two traffic signals located in this segment, at Riggs Rd and at the I-10 ramps.

Figure 2: Corridor Location and Segments



SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Project Vicinity and Segmentation

1.5 Corridor Characteristics

The SR 347/SR 84 corridor is an important travel corridor in the southcentral part of the state. The corridor functions as a route for agricultural, freight, recreational, commuting, and regional traffic and provides critical connections between the communities it serves and the rest of the regional and interstate network.

National Context

The SR 347/SR 84 corridor is a vital link across southcentral Arizona that connects the City of Maricopa, GRIC, and the Ak-Chin Indian Community to the Phoenix metropolitan area. It is a strategic transportation link across southcentral Arizona for freight and intercity travel.

Regional Connectivity

The SR 347/SR84 corridor between I-10 and I-8 provides movement for travel within southcentral Arizona. The corridor is located in two ADOT Districts (Central and Southcentral); two planning areas (Maricopa Association of Governments [MAG] and Central Arizona Governments [CAG]); and two counties (Maricopa and Pinal). Within the corridor study limits, SR 347/SR 84 offers connections to several major roadways, including I-10, Riggs Road, SR 238, Maricopa-Casa Grande Highway, and I-8. This corridor serves the City of Maricopa as well as GRIC and the Ak-Chin Indian Community.

Commercial Truck Traffic

Communities along the SR 347/SR 84 corridor are dependent on the corridor to access the state economy through freight deliveries and travel to other locations. Freight traffic (trucks) comprise from 6% to 13% of the total traffic flow on the corridor, with the higher truck percentages within the southern portion of the corridor. The section of SR 347 between I-10 and SR 238 is frequently traveled by trucks hauling loads to the regional landfill on SR 238 west of SR 347. The corridor is also used as an oversized truck route.

Commuter Traffic

A majority of the commuter traffic along the SR 347/SR 84 corridor occurs between the City of Maricopa and I-10. The SR 347/84 corridor is considered rural in character except within the City of Maricopa. According to the most recent traffic volume data maintained by ADOT, traffic volumes range from approximately 1,200 vehicles per day on SR 84 near the I-8 traffic interchange (TI) to over 40,000 vehicles per day north of the City of Maricopa on SR 347.

According to the 2013 American Community Survey data from the US Census Bureau, 80% to 90% of the workforce in areas along the corridor relies on a private vehicle to get to work.

Recreation and Tourism

The SR 347/SR 84 corridor provides access to the Sonoran Desert National Monument via SR 238 or I-8.

Multimodal Uses

Freight Rail

The Union Pacific Railroad (UPRR) “Sunset Route” crosses the corridor within the City of Maricopa. The UPRR Sunset Route connects Los Angeles with El Paso and passes through Southern Arizona in an east-west direction through Yuma, Wellton, Gila Bend, Maricopa, Casa Grande, Eloy, Marana, Tucson, Benson and Willcox. The UPRR Sunset Route typically carries between 45 and 65 trains per day.

Passenger Rail

Amtrak’s Sunset Limited (New Orleans to Los Angeles) and Texas Eagle (Chicago to Los Angeles) routes serve long-distance tourist travel with daily service. The Sunset Limited and Texas Eagle routes share track with the UPRR Sunset Route and are subject to delays caused by freight traffic. There is a passenger station in the City of Maricopa. Other passenger stations are located in Yuma, Tucson, and Benson.

Bicycles/Pedestrians

Opportunities for bicycle and pedestrian travel are somewhat limited on SR 347/SR 84. Bicycle traffic is permitted on the mainline outside shoulder in rural areas. Outside shoulder widths on the rural SR 347 portions of the corridor are around ten feet wide. Outside shoulder widths on the SR 84 portion are five feet wide. Sidewalks are provided along SR 347 through parts of the City of Maricopa but are not continuous.

Bus/Transit

The City of Maricopa provides several types of transit services through the City of Maricopa Express Transit (COMET) system. These transit types include local demand response, local limited demand response, route deviation services, regional demand response, and Valley Metro vanpool. These transit options typically require a reservation or run on a very limited basis. The route deviation services generally have stops at the Pinal County Public Health Clinic/Library, Legacy School, Central Arizona College, Copper Sky Recreation Center, Sun Life Medical, COPA Senior Center, and Sun Life Women’s Center.

Aviation

There are two general aviation facilities in proximity to the SR 347/SR 84 corridor. These include Stellar Airpark, owned and operated by the Stellar Runway Utilizers Association, and the Ak-Chin Regional Airport (formerly Phoenix Regional Airport), owned and operated by the Ak-Chin Indian Community. The northern portion of the corridor serves as a connection to numerous other airports located in the Phoenix metropolitan area via I-10 and the Loop 202.

Land Ownership, Land Uses and Jurisdictions

As shown previously in **Figure 2**, the SR 347/SR 84 corridor traverses multiple jurisdictions and land owned or managed by various entities. The southern section of the corridor traverses privately held and State Trust land. A portion of the central segment of the corridor traverses the Ak-Chin Indian Community. The northern section of the corridor traverses GRIC. Land ownership in and surrounding the City of Maricopa is mainly private land.

Population Centers

Population centers of various sizes exist along the SR 347/SR 84 corridor. **Table 2** provides a summary of the populations for communities along the corridor. Significant population growth is projected between 2010 and 2040 in the City of Maricopa and in the corridor vicinity according to the Arizona State Demographer's Office.

Table 2: Current and Future Population

Community	2010 Population	2015 Population	2040 Population	% Change 2010-2040	Total Growth
Maricopa County	3,824,058	4,076,438	6,030,950	58%	2,206,892
Gila River	3,000	3,000	3,300	10%	300
Pinal County	376,369	406,468	800,707	113%	424,338
Maricopa	43,598	48,374	97,013	123%	53,415

Source: U.S. Census, Arizona Department of Administration – Employment and Population Statistics

Major Traffic Generators

The Phoenix metropolitan area, along with the City of Maricopa, are major traffic generators for the SR 347/SR 84 corridor.

Tribes

Portions of the SR 347/SR 84 corridor lie within GRIC and the Ak-Chin Indian Community.

Wildlife Linkages

The Arizona State Wildlife Action Plan (SWAP) provides a 10-year vision for the entire state, identifying wildlife and habitats in need of conservation, insight regarding the stressors to those resources, and actions that can be taken to alleviate those stressors. Using the Habimap Tool that creates an interactive database of information included in the SWAP, the following were identified in relation to the SR 347/SR 84 corridor:

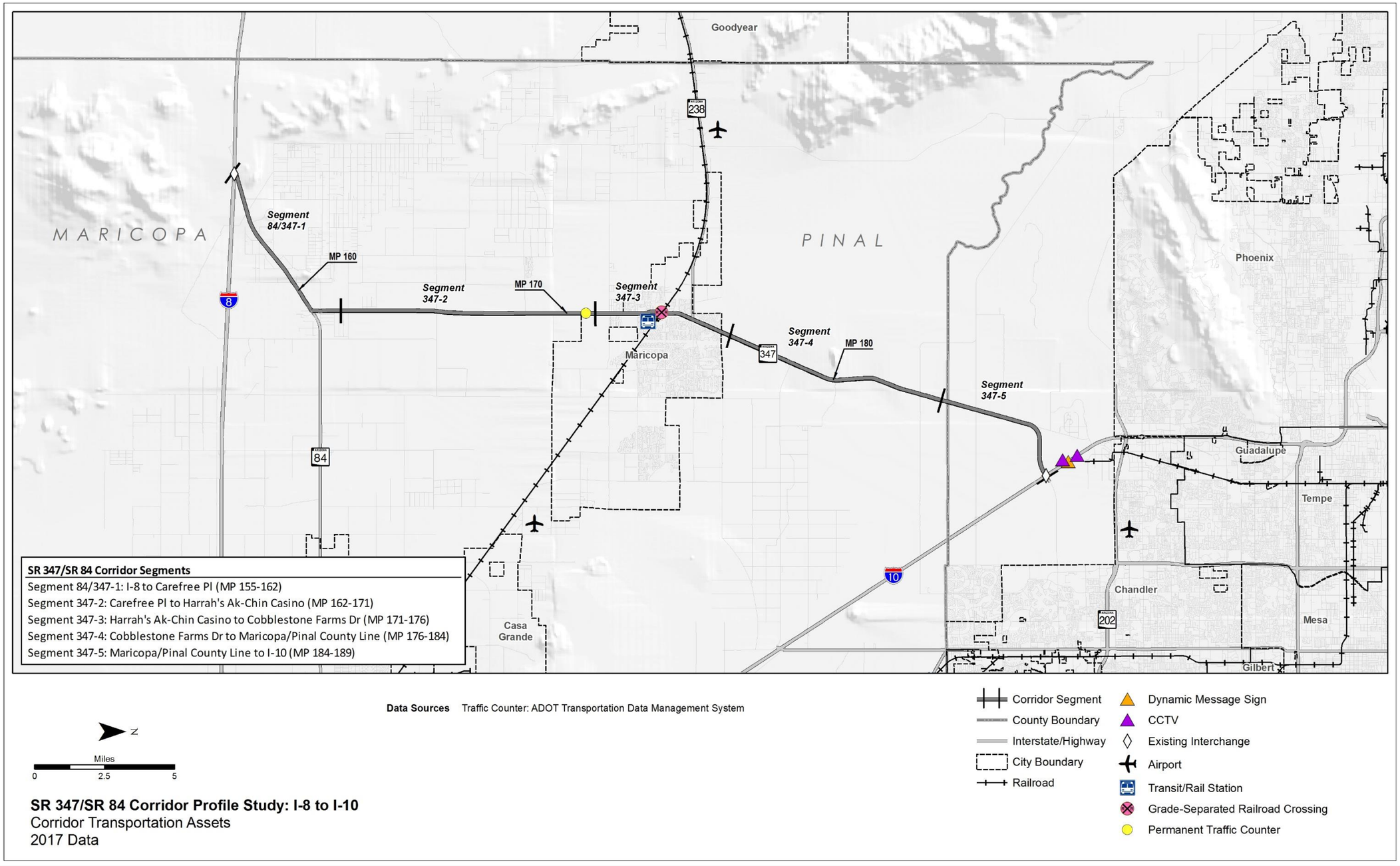
- Arizona Game and Fish Department (AGFD) Wildlife Waters are located near the southern portion of the corridor, specifically in the areas to the north and south of the SR 84/I-8 TI
- The corridor travels through a few allotments controlled by the Arizona State Land Department (ASLD)
- Riparian areas include a few small areas adjacent to SR 347 near the City of Maricopa and on the east and west sides of SR 347 near the SR347/SR84 junction
- Arizona Wildlife Linkages: No missing or potential wildlife linkages are noted
- According to the Species and Habitat Conservation Guide (SHCG), sensitive habitats that have moderate to high conservation potential exist along the corridor; these areas are located primarily on the southern half of the corridor, with the highest conservation potential on the SR 84 section of the corridor
- Areas where Species of Greatest Conservation Need (SGCN) are high or moderately vulnerable are similar to the areas identified in the SHCG (see above), with those of highest conservation need located along the SR 84 section of the corridor
- Identified areas of moderate or high levels of Species of Economic and Recreational Importance (SERI) exist along the corridor; these are located primarily on the southern half of the corridor

Corridor Assets

Corridor transportation assets are summarized in **Figure 3**. An at-grade railroad crossing is located on SR 347 near MP 173.4. ADOT is currently in the process of constructing this crossing to be grade-separated. Construction for this project is scheduled to be complete in late 2019. The Maricopa Amtrak transit station is currently located on the east side of SR 347 near MP 173.4 but will be relocating to the west side of SR 347 in near future.

The corridor includes two grade-separated TIs: one at the northern terminus of the corridor involving SR 347 and I-10 and another at the southern terminus of the corridor involving SR 84 and I-8. There is a permanent traffic counter on SR 347 at MP 171.7. Within the corridor vicinity there are closed circuit television (CCTV) cameras and Dynamic Message Signs (DMS on I-10, along with various small General Aviation or private airports.

Figure 3: Corridor Assets



SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Corridor Transportation Assets
2017 Data

1.6 Corridor Stakeholders and Input Process

A Technical Advisory Committee (TAC) was created that was comprised of representatives from key stakeholders. TAC meetings were held at key milestones to present results and obtain feedback. In addition, meetings were conducted with key stakeholders in July 2017 to present the results and obtain feedback.

Key stakeholders identified for this study included:

- ADOT Central District
- ADOT Southcentral District
- ADOT Technical Groups
- MAG
- CAG
- AGFD
- ASLD
- Federal Highway Administration (FHWA)

1.7 Prior Studies and Recommendations

This study identified recommendations from previous studies, plans, and preliminary design documents. Studies, plans, and programs pertinent to the SR 347/SR 84 corridor were reviewed to understand the full context of future planning and design efforts within and around the study area. These studies are organized below into four categories: Framework and Statewide Studies, Regional Planning Studies, Planning Assistance for Rural Areas (PARAs) and Small Area Transportation Studies (SATS), and Design Concept Reports (DCRs) and Project Assessments (PAs).

Framework and Statewide Studies

- ADOT Bicycle and Pedestrian Plan Update (2013)
- ADOT Pedestrian Safety Action Plan (2017)
- ADOT Five-Year Transportation Facilities Construction Program (2018 – 2022)
- ADOT Climbing and Passing Lane Prioritization Study (2015)
- ADOT Arizona Key Commerce Corridors (2014)
- ADOT Arizona Multimodal Freight Analysis Study (2009)
- ADOT Arizona Ports of Entry Study (2013)
- ADOT Arizona State Airport Systems Plan (2008)
- ADOT Arizona State Freight Plan (2016)
- ADOT Arizona State Rail Plan (2011)
- AGFD Arizona State Wildlife Action Plan (2012) / Arizona Wildlife Linkages Assessment
- ADOT Arizona Statewide Dynamic Message Sign Master Plan (2011)
- ADOT Arizona Statewide Rail Framework Study (2010)
- ADOT Arizona Statewide Rest Area Study (2011)
- ADOT Arizona Statewide Shoulders Study (2015)
- ADOT Arizona Strategic Highway Safety Plan (2014)
- ADOT Arizona Roadway Departure Safety Implementation Plan (RDSIP) (2014)
- ADOT AASHTO U.S. Bicycle Route System (2015)
- ADOT Low Volume State Routes Study (2017)
- ADOT Statewide Transportation Planning Framework – Building a Quality Arizona (BQAZ) (2010)
- ADOT What Moves You Arizona? Long-Range Transportation Plan (2010-2035)

Regional Planning Studies

- MAG 2035 Regional Transportation Plan (2014)
- MAG Draft 2040 Regional Transportation Plan (2017)
- MAG FY 2017-2021 Transportation Improvement Program (2016)
- MAG Draft FY 2018-2022 Transportation Improvement Program (2017)
- Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009)
- Pinal County Regional Transportation Authority Proposed Projects (2017)
- MAG Regional Transit Framework (2010)
- CAG Regional Transportation Plan (2015)

Planning Assistance for Rural Areas and Small Area Transportation Studies

- Pinal County SATS (2006)
- City of Maricopa Area Transportation Plan (2015)
- Southern Maricopa/Northern Pinal County Area Transportation Study (2003)

Design Concept Reports and Project Assessments

- SR 347: SR 347 at Union Pacific Railroad – Final DCR and Environmental Assessment (2015)
- Pinal County's East-West Corridor Study Final Design Concept Report (2015)
- Wild Horse Pass Circulation Study (2016)

Summary of Prior Recommendations

Various studies and plans, including several DCRs, have recommended improvements to the SR 347/SR 84 corridor as shown in **Table 3** and **Figure 4**. They include, but are not limited to:

- Widening SR 84 to 4 lanes
- Widening SR 347 to 6 lanes or 8 lanes through the City of Maricopa
- Constructing a grade-separated railroad crossing with bike lanes and sidewalks in the City of Maricopa

- New grade-separated TIs at the following locations:
  - With proposed West Pinal County Freeway
  - With proposed SR 238 Freeway
- New signalized intersections along SR 347 at the following locations:
  - With proposed Val Vista Parkway
  - With proposed East-West Corridor
  - SR 347/Maricopa Road intersection
- Constructing pedestrian safety improvements along SR 347 through the City of Maricopa including sidewalks and hybrid beacons
- Enhancing transit use along the corridor

Table 3: Corridor Recommendations from Previous Studies

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
SR 84											
1	155	161	6	Widen SR 84 to 4 lanes and classify as an arterial or parkway			√	-	N/A	N	Pinal County Small Area Transportation Study (2006); Pinal County Regionally Significant Routes for Safety and Mobility (2008)
SR 347											
2	161	173	12	Widen SR 347 to 6-lane arterial or 8-lane parkway and extend it down from SR 84 to I-8			√	-	N/A	N	MAG Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009); MAG Draft 2040 Regional Transportation Plan (2017); Pinal County Regionally Significant Routes for Safety and Mobility (2008); Pinal County Small Area Transportation Study (2006); CAG Regional Transportation Plan (2015)
3	161	173	12	Bus rapid transit with proposed park-and-ride near the SR 347/McCartney Road intersection		√		-	N/A	N	MAG 2035 Regional Transportation Plan (2014); MAG Draft 2040 Regional Transportation Plan (2017)
4	164	164	-	New traffic interchange with proposed West Pinal County Freeway			√	-	N/A	N	Proposed Pinal County Regional Transportation Authority Projects (2017); Pinal County East-West Corridor Study Final DCR (2015); MAG Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009)
5	166	166	-	New signalized intersection with proposed Val Vista Parkway			√	-	N/A	N	Pinal County East-West Corridor Study Final DCR (2015); Pinal County Regionally Significant Routes for Safety and Mobility (2008); MAG Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009)
6	171	171	-	New signalized intersection with proposed East-West Corridor that becomes east leg of existing signalized Harrah's Ak-Chin Casino entrance along SR 347			√	-	N/A	N	Pinal County East-West Corridor Study Final DCR (2015)
7	171.4	175.4	4.0	Construct a raised median and sidewalk between MP 172.9-173.8; provide a pedestrian hybrid beacon at the intersection of Alterra Parkway/M.L.K. Jr. Boulevard; recommended location for RSA		√		-	N/A	N	ADOT Pedestrian Safety Action Plan (2017)

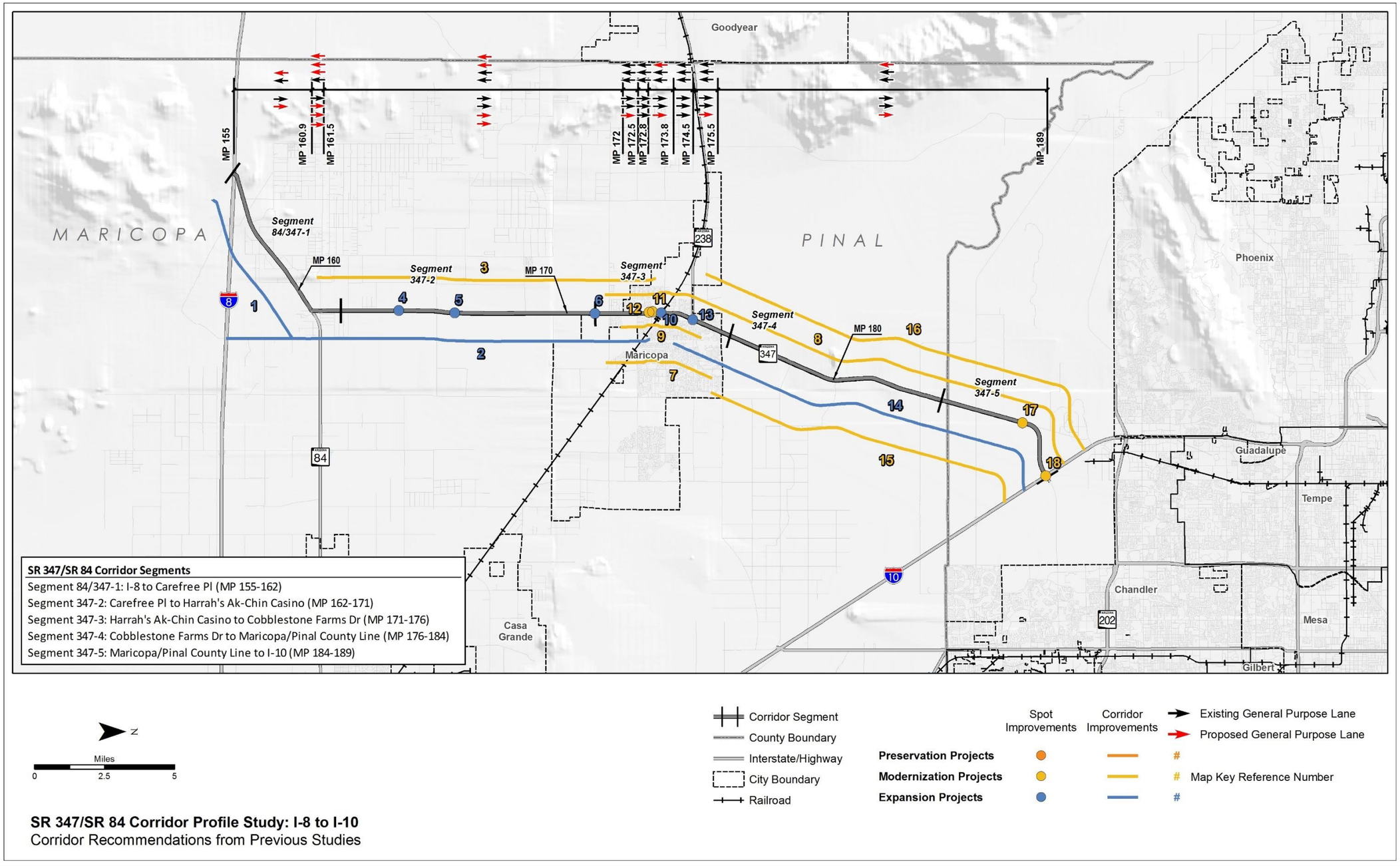
Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
8	171	189	18	New adaptive traffic signal control and microwave link for signals		√		-	N/A	N	City of Maricopa Area Transportation Plan (2015); MAG FY 2017-2021 Transportation Improvement Program (2016)
9	172	175	3	Add sidewalks where gaps exist		√		-	N/A	N	CAG Regional Transportation Plan (2015); ADOT Statewide Bicycle and Pedestrian Plan Update (2013)
10	173	173	-	Grade-separated railroad crossing with bike lanes and sidewalks			√	2017	6350	Y	MAG FY 2017-2021 Transportation Improvement Program (2016); City of Maricopa Area Transportation Plan (2015); ADOT SR 347: SR 347 at Union Pacific Railroad – Final DCR and Environmental Assessment (2015); ADOT 2017-2021 Five-Year Transportation Facilities and Construction Program; ADOT Arizona State Rail Plan (2011)
11	173	173	-	Relocate existing Amtrak station 1.25 miles to the northwest along existing rail line		√		-	N/A	N	City of Maricopa Area Transportation Plan (2015)
12	173	173	-	Traffic signal communication link on Honeycutt Road across SR 347		√		-	N/A	N	MAG FY 2017-2021 Transportation Improvement Program (2016)
13	174	174	-	New traffic interchange with proposed SR 238 freeway			√	-	N/A	N	MAG Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009)
14	174	189	15	Widen SR 347 to 6 lanes			√	-	N/A	N	Pinal County Small Area Transportation Study (2006); Pinal County Regionally Significant Routes for Safety and Mobility (2008); CAG Regional Transportation Plan (2015); City of Maricopa Area Transportation Plan (2015); MAG Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009); BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010); MAG Wild Horse Pass Circulation Study (2016)
15	176	189	13	Roadway departure countermeasures: • Edge line rumble strips or shoulder rumble strips (MPs 176.5-177.0, 178.0-180.50, 181.0-185.5, 186.0-188.5, 189.0-189.5) • Alignment delineation, lighting (MPs 184.0-184.5, 187.0-187.5, 189.0-189.5)		√		-	N/A	N	ADOT Arizona RDSIP (2014)

Table 3: Corridor Recommendations from Previous Studies (continued)

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)?	
16	174	189	15	Enhanced transit and express bus with proposed park-and-ride at SR 347/SR 238 and local transit in Maricopa		√		-	N/A	N	MAG 2035 Regional Transportation Plan (2014); MAG Draft 2040 Regional Transportation Plan (2017); MAG Regional Transit Framework Final Report (2010); MAG Interstates 8 and 10 Hidden Valley Transportation Framework Study (2009); BQAZ 2010 Statewide Transportation Planning Framework Final Report (2010)
17	187	187	-	Signalize existing SR 347/Maricopa Road intersection and provide dual southbound left turn lanes and a westbound acceleration lane		√		-	N/A	N	MAG Wild Horse Pass Circulation Study (2016)
18	189	189	-	Convert SR 347/I-10 traffic interchange from conventional diamond to diverging diamond interchange		√		-	N/A	N	MAG Wild Horse Pass Circulation Study (2016)

Figure 4: Corridor Recommendations from Previous Studies



SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Corridor Recommendations from Previous Studies

2.0 CORRIDOR PERFORMANCE

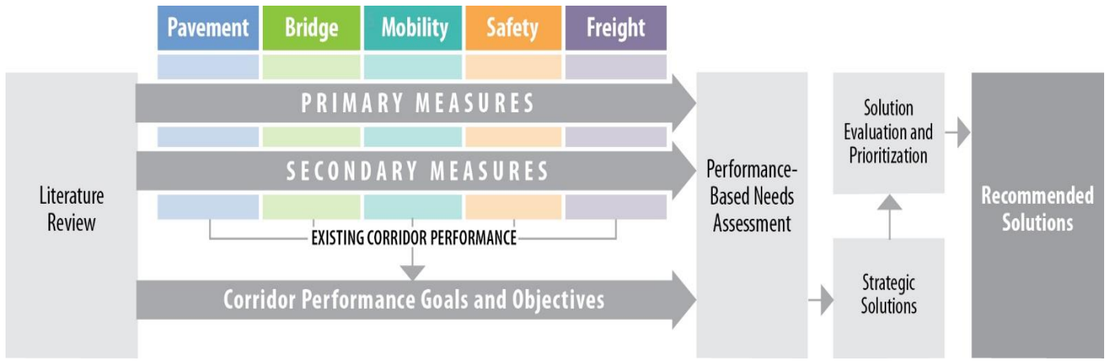
This chapter describes the evaluation of the existing performance of the SR 347/SR 84 corridor. A series of performance measures is used to assess the corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

2.1 Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure 5 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance. The primary measures in each of five performance areas are used to define the overall health of the corridor, while the secondary measures identify locations that warrant further diagnostic investigation to delineate needs. Needs are defined as the difference between baseline corridor performance and established performance objectives.

Figure 5: Corridor Profile Performance Framework



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

These performance areas reflect national performance goals stated in *Moving Ahead for Progress in the 21st Century* (MAP-21):

- Safety: To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- Infrastructure Condition: To maintain the highway infrastructure asset system in a state of good repair
- Congestion Reduction: To achieve a significant reduction in congestion on the National Highway System
- System Reliability: To improve the efficiency of the surface transportation system
- Freight Movement and Economic Vitality: To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
- Environmental Sustainability: To enhance the performance of the transportation system while protecting and enhancing the natural environment
- Reduced Project Delivery Delays: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion

The MAP-21 performance goals were considered in the development of ADOT's P2P process, which integrates transportation planning with capital improvement programming and project delivery. Because the P2P program requires the preparation of annual transportation system performance reports using the five performance areas adopted for the CPS, consistency is achieved in the performance measures used for various ADOT analysis processes.

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance.

Each of the primary and secondary performance measures is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance – Rating is above the identified desirable/average range

Fair/Average Performance – Rating is within the identified desirable/average range

Poor/Below Average Performance – Rating is below the identified desirable/average range

Table 4 provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table 4: Corridor Performance Measures

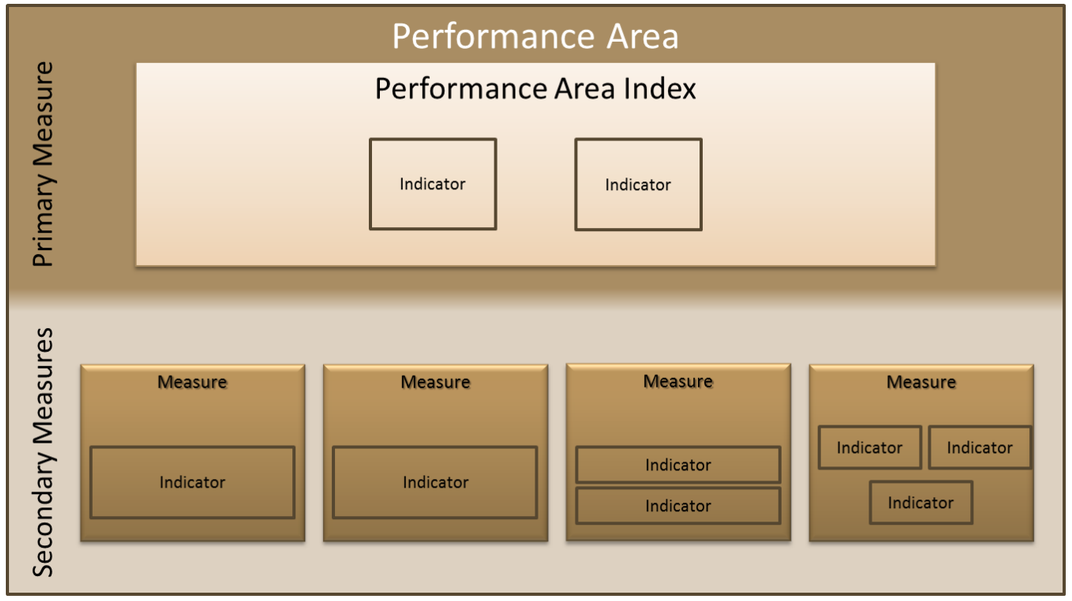
Performance Area	Primary Measure	Secondary Measures
Pavement	**Pavement Index** Based on a combination of International Roughness Index and cracking	• Directional Pavement Serviceability • Pavement Failure • Pavement Hot Spots
Bridge	**Bridge Index** Based on lowest of deck, substructure, superstructure and structural evaluation rating	• Bridge Sufficiency • Functionally Obsolete Bridges • Bridge Rating • Bridge Hot Spots
Mobility	**Mobility Index** Based on combination of existing and future daily volume-to-capacity ratios	• Future Congestion • Peak Congestion • Travel Time Reliability • Multimodal Opportunities
Safety	**Safety Index** Based on frequency of fatal and incapacitating injury crashes	• Directional Safety Index • Strategic Highway Safety Plan Emphasis Areas • Crash Unit Types • Safety Hot Spots
Freight	**Freight Index** Based on bi-directional truck planning time index	• Recurring Delay • Non-Recurring Delay • Closure Duration • Bridge Vertical Clearance • Bridge Vertical Clearance Hot Spots

The general template for each performance area is illustrated in **Figure 6**.

The guidelines for performance measure development are:

- Indicators and performance measures for each performance area should be developed for relatively homogeneous corridor segments
- Performance measures for each performance area should be tiered, consisting of primary measure(s) and secondary measure(s)
- Primary and secondary measures should assist in identifying those corridor segments that warrant in-depth diagnostic analyses to identify performance-based needs and a range of corrective actions known as solution sets
- One or more primary performance measures should be used to develop a Performance Index to communicate the overall health of a corridor and its segments for each performance area; the Performance Index should be a single numerical index that is quantifiable, repeatable, scalable, and capable of being mapped; primary performance measures should be transformed into a Performance Index using mathematical or statistical methods to combine one or more data fields from an available ADOT database
- One or more secondary performance measure indicators should be used to provide additional details to define corridor locations that warrant further diagnostic analysis; secondary performance measures may include the individual indicators used to calculate the Performance Index and/or “hot spot” features

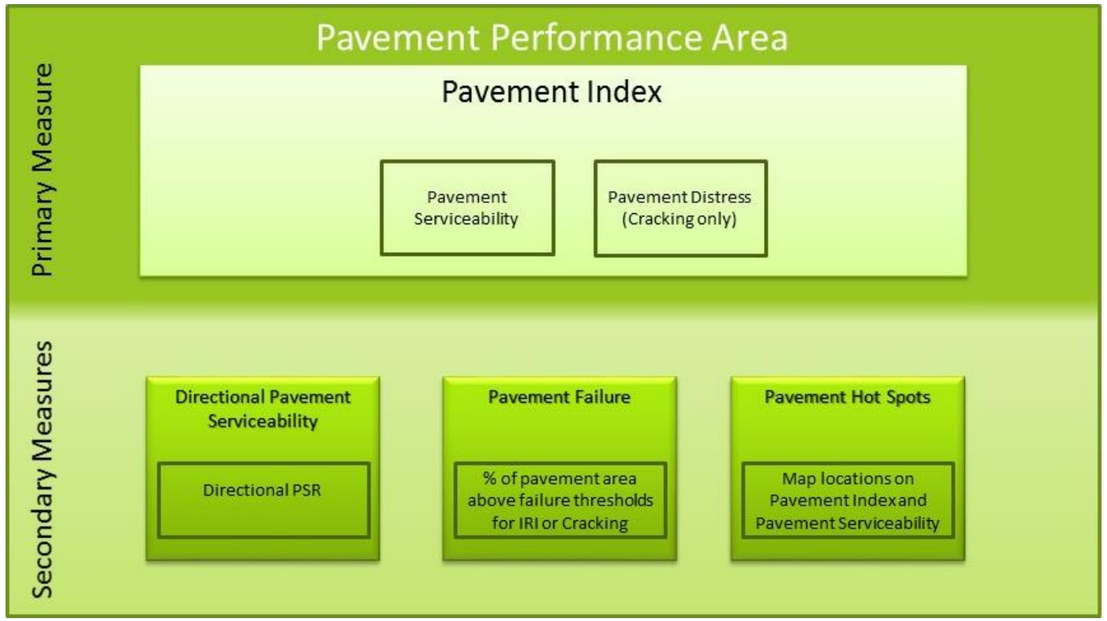
Figure 6: Performance Area Template



2.2 Pavement Performance Area

The Pavement performance area consists of a primary measure (Pavement Index) and three secondary measures, as shown in **Figure 7**. These measures assess the condition of the existing pavement along the SR 347/SR 84 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 7: Pavement Performance Measures



Primary Pavement Index

The Pavement Index is calculated using two pavement condition ratings: the Pavement Serviceability Rating (PSR) and the Pavement Distress Index (PDI).

The PSR is extracted from the International Roughness Index (IRI), a measurement of pavement roughness based on field-measured longitudinal roadway profiles. The PDI is extracted from the Cracking Rating (CR), a field-measured sample from each mile of highway.

Both the PSR and PDI use a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest. The Pavement Index for each segment is a weighted average of the directional ratings based on the number of travel lanes. Therefore, the condition of a section with more travel lanes will have a greater influence on the resulting segment Pavement Index than the condition of a section with fewer travel lanes.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Pavement performance area, the relevant operating environments are designated as interstate and non-interstate segments. For the SR 347/SR 84 corridor, the following operating environment was identified:

- Non-interstate: all segments

Secondary Pavement Measures

Three secondary measures provide an in-depth evaluation of the different characteristics of pavement performance.

Directional Pavement Serviceability

- Weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel

Pavement Failure

- Percentage of pavement area rated above failure thresholds for IRI or Cracking

Pavement Hot Spots

- A Pavement “hot spot” exists where a given one-mile section of roadway rates as being in “poor” condition
- Highlights problem areas that may be under-represented in a segment average; this measure is recorded and mapped, but not included in the Pavement performance area rating calculations

Pavement Performance Results

The Pavement Index provides a high-level assessment of the pavement condition for the corridor and for each segment. The three secondary measures provide more detailed information to assess pavement performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Pavement Index shows “good” overall performance for the SR 347/SR 84 corridor
- According to the Pavement Index, all segments have pavement in “good” condition
- Pavement condition data was missing for MP 155-161 on SR 84 in Segment 84/347-1; the pavement condition ratings were assumed to be the same as the adjacent mile
- The weighted average of the Directional PSR shows “good” overall performance for the SR 347/SR 84 corridor
- Segments 347-2 and 347-5 and the weighted average for the corridor show “fair” % Area Failure ratings; Segment 347-3 shows “poor” ratings

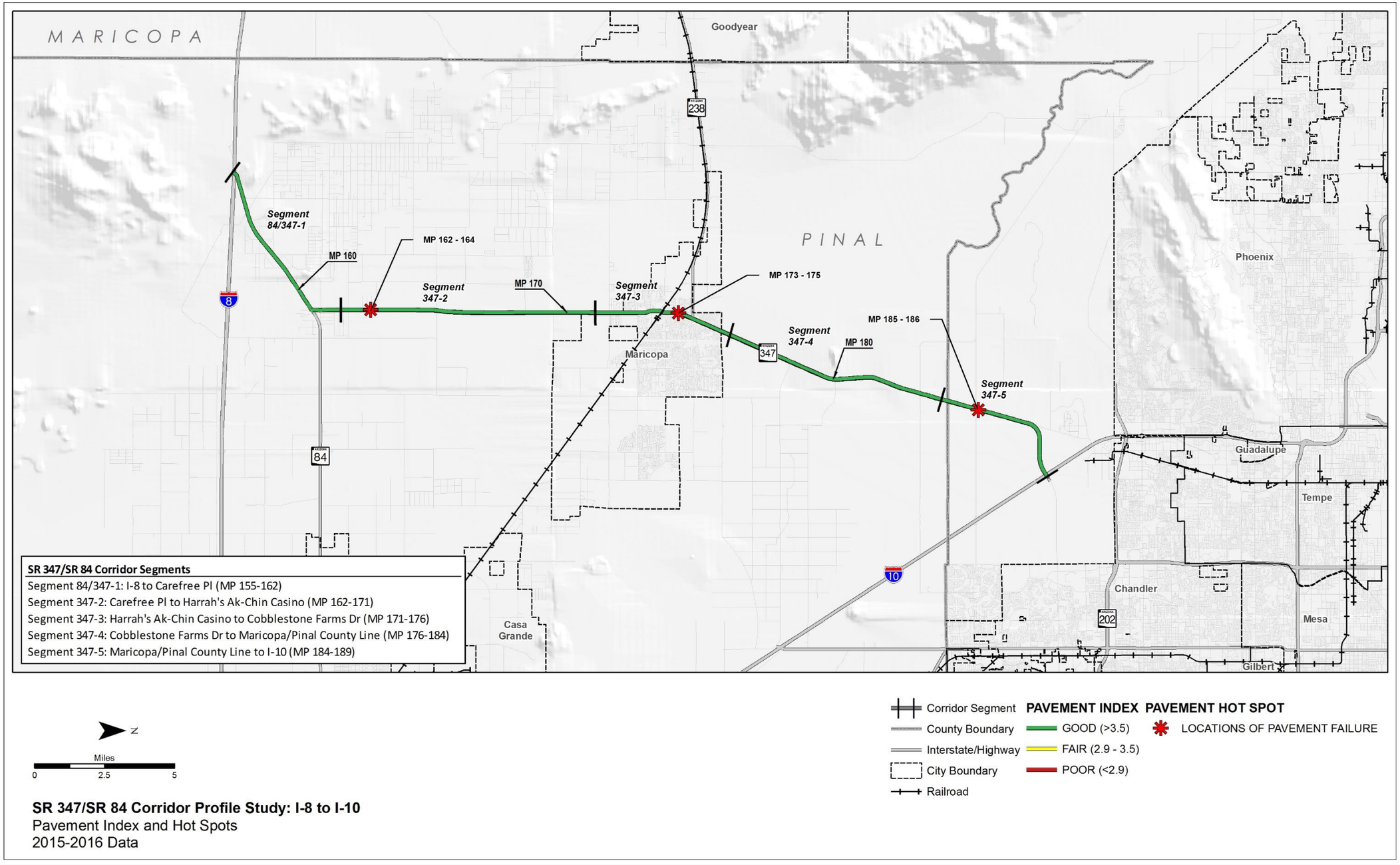
- Pavement hot spots along the corridor include:
  - Segment 347-2: NB/EB MP 162-164
  - Segment 347-3: NB/EB MP 173-175
  - Segment 347-5: NB/EB MP 185-186

Table 5 summarizes the Pavement performance results for the SR 347/SR 84 corridor. **Figure 8** illustrates the primary Pavement Index performance and locations of Pavement hot spots along the SR 347/SR 84 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 5: Pavement Performance

Segment #	Segment Length (miles)	Pavement Index	Directional PSR		% Area Failure
			NB/EB	SB/WB	
84/347-1	7	4.13	4.09	4.18	0.0%
347-2	9	3.86	4.07	4.23	11.1%
347-3	5	3.81	3.21	3.59	29.2%
347-4	8	3.95	3.86	3.95	0.0%
347-5	5	3.97	3.76	4.03	10.0%
Weighted Corridor Average		3.94	3.85	4.03	8.7%
SCALES					
Performance Level		**Non-Interstate**			
Good		> 3.50			< 5%
Fair		2.90 - 3.50			5% - 20%
Poor		< 2.90			> 20%

Figure 8: Pavement Performance

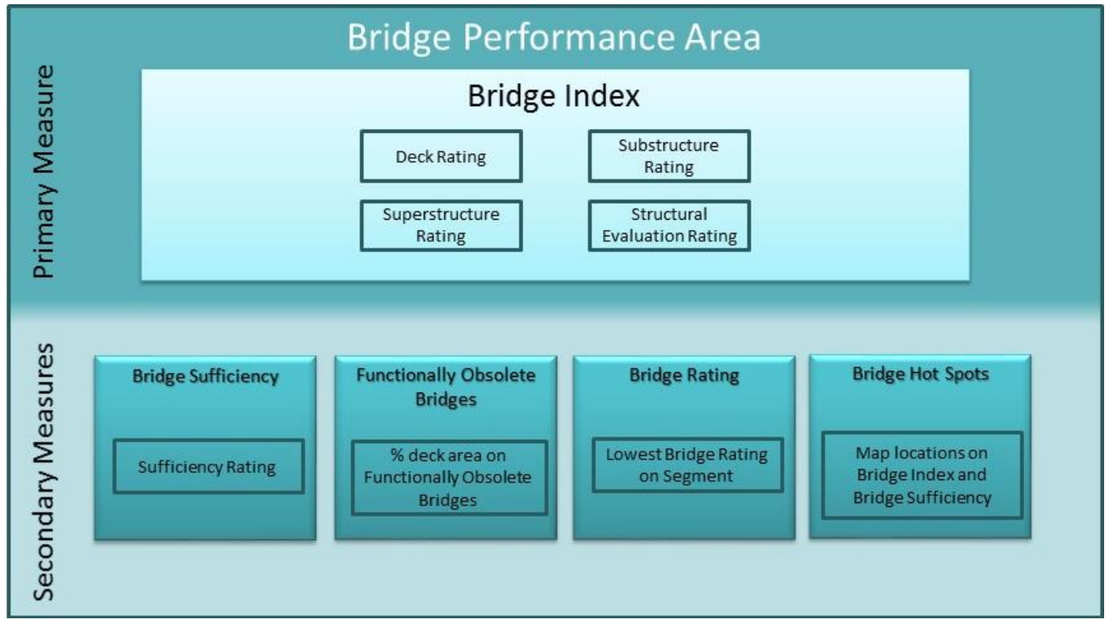


SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Pavement Index and Hot Spots
2015-2016 Data

2.3 Bridge Performance Area

The Bridge performance area consists of a primary measure (Bridge Index) and four secondary measures, as shown in **Figure 9**. These measures assess the condition of the existing bridges along the SR 347/SR 84 corridor. Only bridges that carry mainline traffic or bridges that cross the mainline are included in the calculation. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 9: Bridge Performance Measures



Primary Bridge Index

The Bridge Index is calculated based on the use of four different bridge condition ratings from the ADOT Bridge Database, also known as the Arizona Bridge Information and Storage System (ABISS). The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. These ratings are based on inspection reports and establish the structural adequacy of each bridge. The performance of each individual bridge is established by using the lowest of these four ratings. The use of these ratings, and the use of the lowest rating, is consistent with the approach used by the ADOT Bridge Group to assess the need for bridge rehabilitation. The Bridge Index is calculated as a weighted average for each segment based on deck area.

Secondary Bridge Measures

Four secondary measures provide an in-depth evaluation of the characteristics of each bridge:

Bridge Sufficiency

- Multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour
- Rates the structural and functional sufficiency of each bridge on a 100-point scale

Functionally Obsolete Bridges

- Percentage of total deck area in a segment that is on functionally obsolete bridges
- Identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails
- A bridge that is functionally obsolete may still be structurally sound

Bridge Rating

- The lowest rating of the four bridge condition ratings (substructure, superstructure, deck, and structural evaluation) on each segment
- Identifies lowest performing evaluation factor on each bridge

Bridge Hot Spots

- A Bridge “hot spot” is identified where a given bridge has a bridge rating of 4 or lower or multiple ratings of 5 between the deck, superstructure, and substructure ratings
- Identifies particularly low-performing bridges or those that may decline to low performance in the immediate future

Bridge Performance Results

The Bridge Index provides a high-level assessment of the structural condition of bridges for the corridor and for each segment. The four secondary measures provide more detailed information to assess bridge performance.

Based on the results of this analysis, the following observations were made:

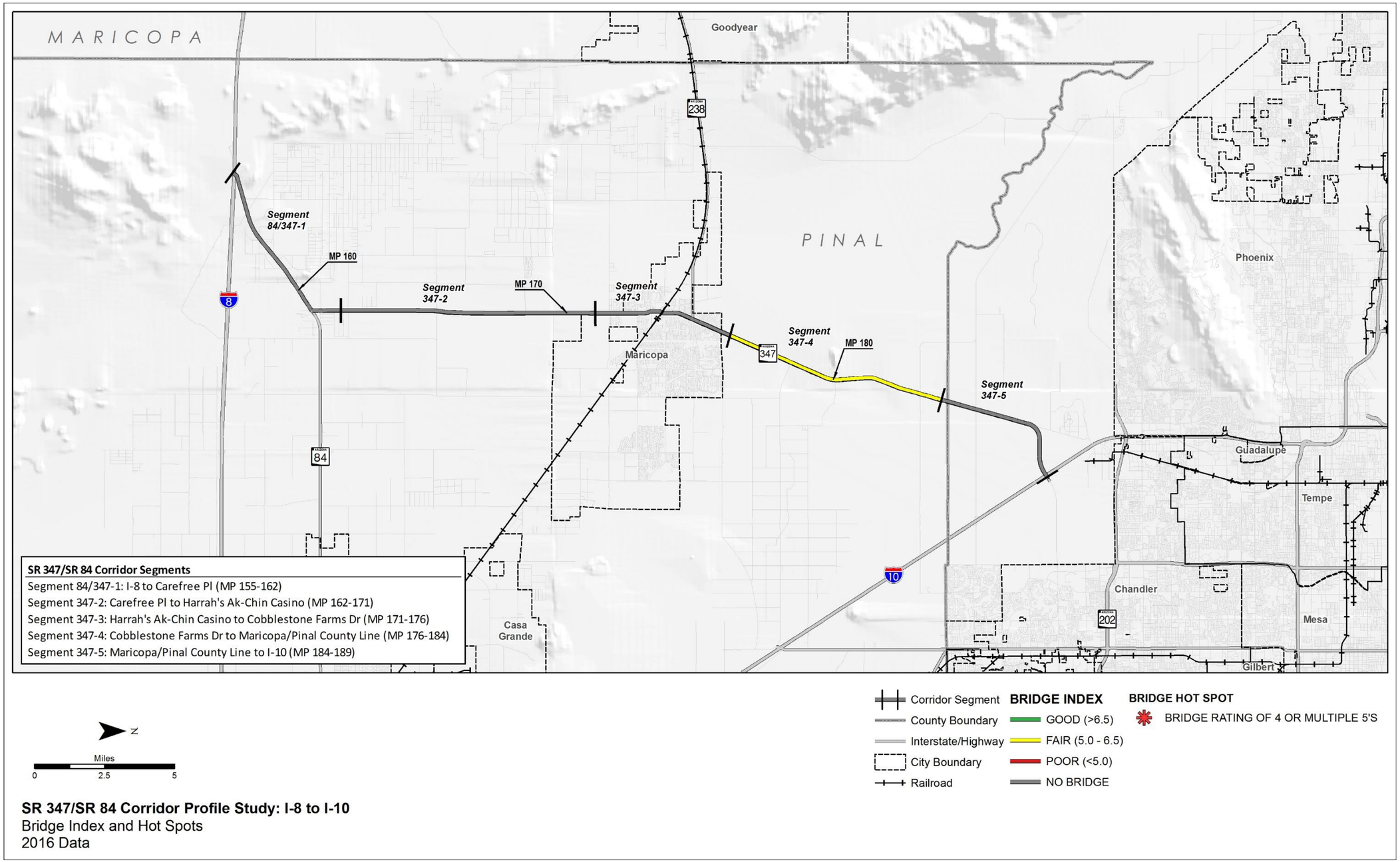
- Only Segment 347-4 contains bridges on the SR 347/SR 84 corridor
- The Bridge Index and Lowest Bridge Rating show “fair” performance for the SR 347/SR 84 corridor
- The Sufficiency Rating and % of Deck Area on Functionally Obsolete Bridges show “good” performance for the SR 347/SR 84 corridor
- There are no bridge hot spots along the corridor

Table 6 summarizes the Bridge performance results for the SR 347/SR 84 corridor. **Figure 10** illustrates the primary Bridge Index performance and locations of Bridge hot spots along the SR 347/84 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 6: Bridge Performance

Segment #	Segment Length (miles)	# of Bridges	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating
84/347-1	7	0	No Bridges			
347-2	9	0	No Bridges			
347-3	5	0	No Bridges			
347-4	8	6	6.20	98.60	0.0%	6
347-5	5	0	No Bridges			
Weighted Corridor Average			6.20	98.60	0.0%	6
SCALES						
Performance Level			**All**			
Good			> 6.5	> 80	< 12%	> 6
Fair			5.0 - 6.5	50 - 80	12% - 40%	5 - 6
Poor			< 5.0	< 50	> 40 %	< 5

Figure 10: Bridge Performance

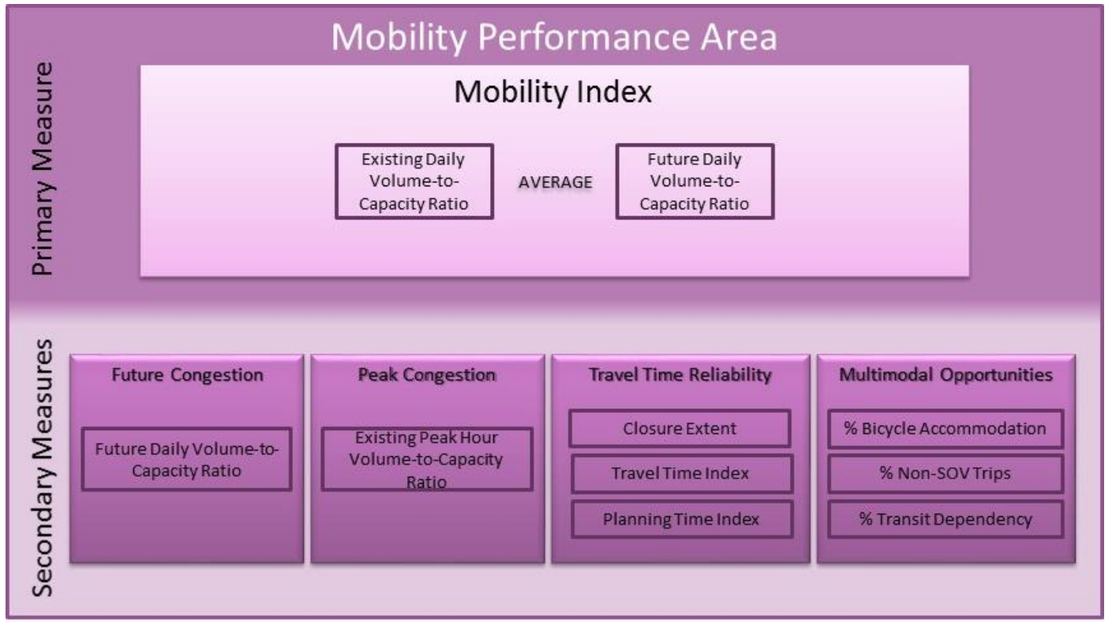


SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Bridge Index and Hot Spots
2016 Data

2.4 Mobility Performance Area

The Mobility performance area consists of a primary measure (Mobility Index) and four secondary measures, as shown in **Figure 11**. These measures assess the condition of existing mobility along the SR 347/SR 84 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 11: Mobility Performance Measures



Primary Mobility Index

The Mobility Index is an average of the existing (2015) daily volume-to-capacity (V/C) ratio and the future (2035 AZTDM) daily V/C ratio for each segment of the corridor. The V/C ratio is an indicator of the level of congestion. This measure compares the average annual daily traffic (AADT) volume to the capacity of the corridor segment as defined by the service volume for level of service (LOS) E. By using the average of the existing and future year daily volumes, this index measures the level of daily congestion projected to occur in approximately ten years (2025) if no capacity improvements are made to the corridor.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Mobility performance area, the relevant operating environments are urban vs. rural setting and interrupted flow (e.g., signalized at-grade intersections are present) vs. uninterrupted flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway). For the SR 347/SR 84 corridor, the following operating environments were identified:

- Urban Interrupted Flow: Segments 347-3
- Rural Interrupted Flow: Segments 84/347-1, 347-2, 347-4 and 347-5

Secondary Mobility Measures

Four secondary measures provide an in-depth evaluation of operational characteristics of the corridor:

Future Congestion – Future Daily V/C

- The future (2035 AZTDM) daily V/C ratio; this measure is the same value used in the calculation of the Mobility Index
- Provides a measure of future congestion if no capacity improvements are made to the corridor

Peak Congestion – Existing Peak Hour V/C

- The peak hour V/C ratio for each direction of travel
- Provides a measure of existing peak hour congestion during typical weekdays

Travel Time Reliability– Three separate travel time reliability indicators together provide a comprehensive picture of how much time may be required to travel within the corridor:

- Closure Extent:
  - The average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average was applied to each closure that takes into account the distance over which the closure occurs
  - Closures related to crashes, weather, or other incidents are a significant contributor to non-recurring delays; construction-related closures were excluded from the analysis
- Directional Travel Time Index (TTI):
  - The ratio of the average peak period travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The TTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- Directional Planning Time Index (PTI):
  - The ratio of the 95th percentile travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The PTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics

    - The PTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

Multimodal Opportunities – Three multimodal opportunity indicators reflect the characteristics of the corridor that promote alternate modes to the single occupancy vehicle (SOV) for trips along the corridor:

- % Bicycle Accommodation:
    - Percentage of the segment that accommodates bicycle travel; bicycle accommodation on the roadway or on shoulders varies depending on traffic volumes, speed limits, and surface type
    - Encouraging bicycle travel has the potential to reduce automobile travel, especially on non-interstate highways
- % Non-SOV Trips:
    - The percentage of trips (less than 50 miles in length) by non-SOVs
    - The percentage of non-SOV trips in a corridor gives an indication of travel patterns along a section of roadway that could benefit from additional multimodal options
- % Transit Dependency:
    - The percentage of households that have zero or one automobile and households where the total income level is below the federally defined poverty level
    - Used to track the level of need among those who are considered transit dependent and more likely to utilize transit if it is available

Mobility Performance Results

The Mobility Index provides a high-level assessment of mobility conditions for the corridor and for each segment. The four secondary measures provide more detailed information to assess mobility performance.

Based on the results of this analysis, the following observations were made:

- Future 2035 volumes for Segments 347-3, 347-4, and 347-5 were obtained from the MAG travel demand model rather than the AZTDM model because the 2035 AZTDM model projections result in negative growth compared to current volumes, which doesn't appear reasonable given the projected population growth in the corridor vicinity
- The weighted average of the Mobility Index shows "fair" overall performance for the SR 347/SR 84 corridor, with Segments 347-3, 347-4, and 347-5 indicating "poor" performance
- During the existing peak hour, traffic operations are "good" for all segments except Segments 347-4 and 347-5
- Segments 347-3, 347-4, and 347-5 are anticipated to have "poor" performance in the future, according to the Future Daily V/C performance indicator
- A majority of the segments have "good" performance in the Closure Extent performance indication for NB/EB and SB/WB travel; Segments 347-4 and 347-5 have "fair" performance in the Closure Extent performance indicator for NB/EB travel
- The TTI performance indicator shows that all segments have "fair" or "good" performance levels
- The PTI performance indicator shows many of the SR 347/SR 84 segments, both NB/EB and SB/WB, have "poor" or "fair" performance in terms of reliability
- A majority of the corridor shows "good" performance in % Bicycle Accommodation, indicating most of the corridor except Segment 347-3 has adequate shoulders for accommodating bicycles
- Segments 347-4 and 347-5 show "poor" performance for % Non-SOV Trips, indicating single occupant trips are common

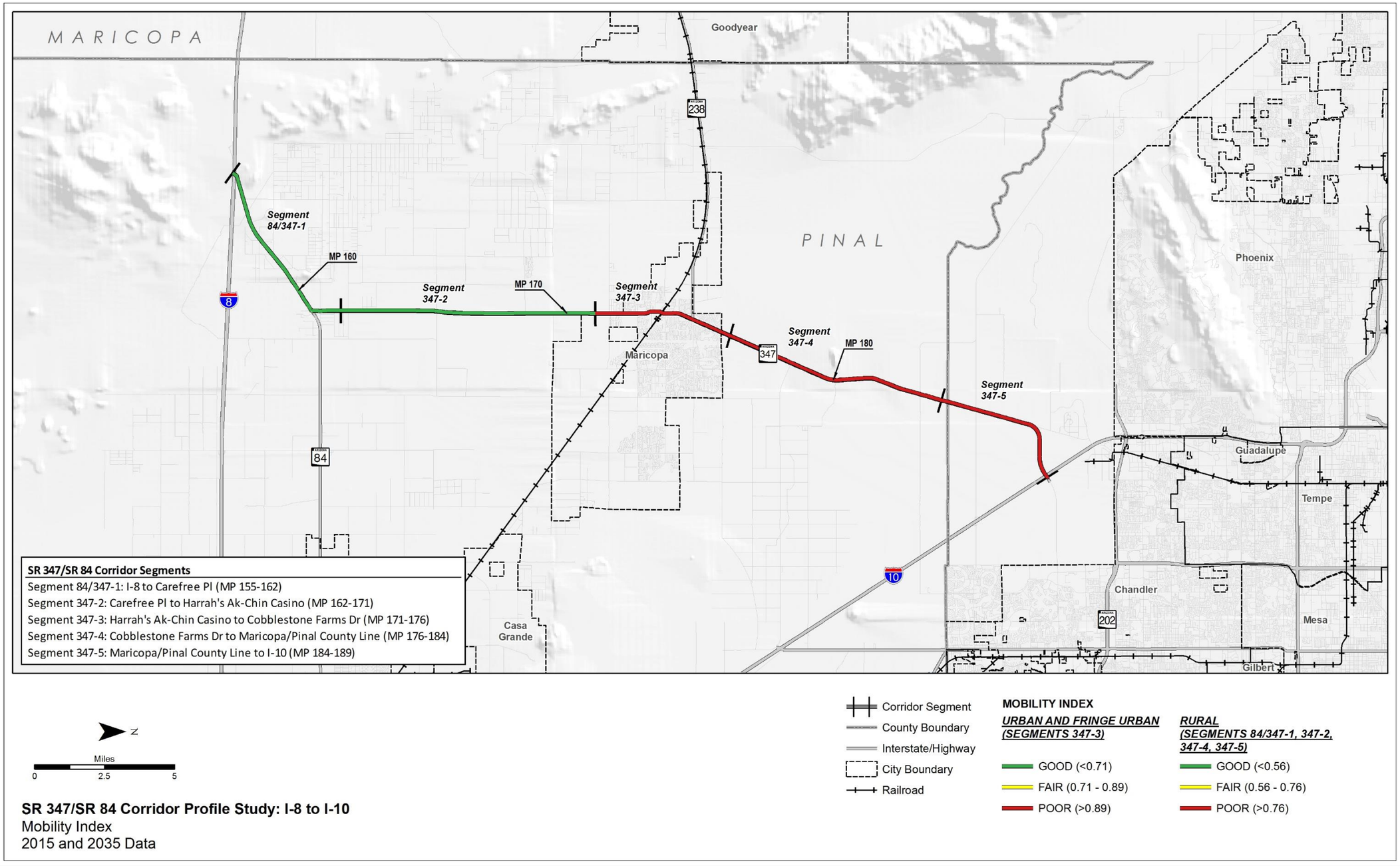
Table 7 summarizes the Mobility performance results for the SR 347/SR 84 corridor. **Figure 12** illustrates the primary Mobility Index performance along the SR 347/SR 84 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 7: Mobility Performance

Segment #	Segment Length (miles)	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
				NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB		
84/347-1[2]*	7	0.12	0.17	0.09	0.08	0.03	0.00	1.00	1.07	2.05	2.86	100%	19.9%
347-2[2]*	9	0.11	0.14	0.06	0.06	0.09	0.13	1.22	1.26	4.72	3.06	100%	20.2%
347-3[1]*	5	1.03	1.33	0.63	0.63	0.16	0.12	1.43	1.43	6.13	4.51	43%	19.1%
347-4[2]*	8	1.47	1.75	1.01	1.03	0.24	0.15	1.24	1.19	3.25	2.24	98%	9.4%
347-5[2]*	5	1.35	1.61	0.90	0.89	0.61	0.12	1.16	1.15	3.05	2.83	98%	9.3%
Weighted Corridor Average		0.76	0.93	0.50	0.50	0.20	0.11	1.20	1.21	3.78	3.01	91%	15.7%
SCALES													
Performance Level		**Urban Rural**		**All**		**Uninterrupted Interrupted**				**All**			
Good		< 0.71[1] < 0.56[2]		< 0.22		< 1.15^ < 1.30*		< 1.30^ < 3.00*		> 90%		> 17%	
Fair		0.71 - 0.89[1] 0.56 - 0.76[2]		0.22 – 0.62		1.15 - 1.33^ 1.30 - 2.00*		1.30 - 1.50^ 3.00 - 6.00*		60% - 90%		11% - 17%	
Poor		> 0.89[1] > 0.76[2]		> 0.62		> 1.33^ > 2.00*		> 1.50^ > 6.00*		< 60%		< 11%	

[1]Urban Operating Environment
[2]Rural Operating Environment
^Uninterrupted Flow Facility
*Interrupted Flow Facility

Figure 12: Mobility Performance

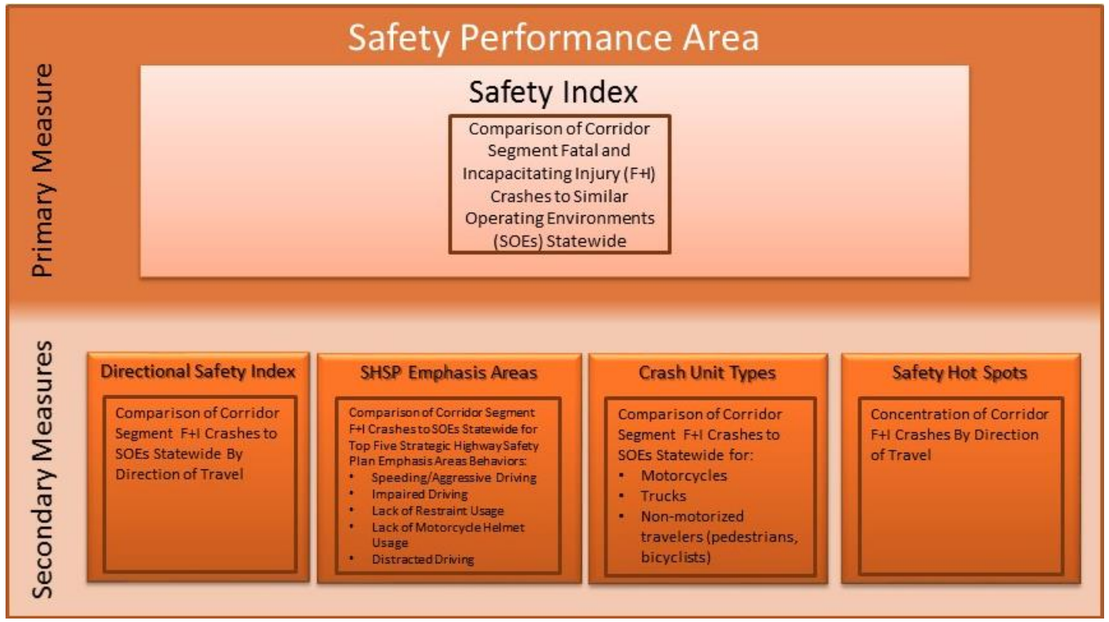


SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Mobility Index
2015 and 2035 Data

2.5 Safety Performance Area

The Safety performance area consists of a primary measure (Safety Index) and four secondary measures, as illustrated in **Figure 13**. All measures relate to crashes that result in fatal and incapacitating injuries, as these types of crashes are the emphasis of the ADOT Strategic Highway Safety Plan (SHSP), FHWA, and MAP-21. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C.**

Figure 13: Safety Performance Measures



Primary Safety Index

The Safety Index is based on the bi-directional frequency and rate of fatal and incapacitating injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2010 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 14.5 times the estimated cost of incapacitating injury crashes ($5.8 million compared to $400,000).

Each corridor segment is rated on a scale by comparing the segment score with the average statewide score for similar operating environments. Because crash frequencies and rates vary depending on the operating environment of a particular roadway, statewide values were developed for similar operating environments defined by functional classification, urban vs. rural setting, number of travel lanes, and traffic volumes. For the SR 347/SR 84 corridor, the following operating environments were identified:

- 2 or 3 Lane Undivided Highway: Segments 84/347-1
- 2 or 3 or 4 Lane Divided Highway: Segments 347-2, 347-3, 347-4, and 347-5

Secondary Safety Measures

Four secondary measures provide an in-depth evaluation of the different characteristics of safety performance:

Directional Safety Index

- This measure is based on the directional frequency and rate of fatal and incapacitating injury crashes

SHSP Emphasis Areas

ADOT's 2014 SHSP identified several emphasis areas for reducing fatal and incapacitating injury crashes. This measure compared rates of crashes in the top five SHSP emphasis areas to other corridors with a similar operating environment. The top five SHSP emphasis areas related to the following driver behaviors:

- Speeding and aggressive driving
- Impaired driving
- Lack of restraint usage
- Lack of motorcycle helmet usage
- Distracted driving

Crash Unit Types

- The percentage of total fatal and incapacitating injury crashes that involves crash unit types of motorcycles, trucks, or non-motorized travelers is compared to the statewide average on roads with similar operating environments

Safety Hot Spots

- The hot spot analysis identifies abnormally high concentrations of fatal and incapacitating injury crashes along the study corridor by direction of travel

For the Safety Index and the secondary safety measures, any segment that has too small of a sample size to generate statistically reliable performance ratings for a particular performance measure is considered to have "insufficient data" and is excluded from the safety performance evaluation for that particular performance measure.

Safety Performance Results

The Safety Index provides a high-level assessment of safety performance for the corridor and for each segment. The four secondary measures provide more detailed information to assess safety performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Safety Index shows “average” performance for the SR 347/SR 84 corridor compared to other segments statewide that have similar operating environments
- The Safety Index value for Segment 347-5 is “below average”, meaning this segment has more crashes than is typical statewide
- The crash unit type performance measures for crashes involving trucks, motorcycles, and non-motorized travelers had insufficient data to generate reliable performance ratings for the SR 347/SR 84 corridor
- Segments 84/347-1, 347-2, and 347-3 had insufficient data to generate reliable performance ratings for crashes involving behaviors associated with the SHSP Top 5 Emphasis Areas
- A total of 41 fatal and incapacitating injury crashes occurred along the SR 347/SR 84 corridor in 2011-2015; of these crashes, 9 were fatal and 32 involved incapacitating injuries
- The Directional Safety Index value for SB/WB Segments 347-2 and 347-5 is “below average”, along with the weighted average for the corridor in the SB/WB direction
- There is one Safety hot spot covering MP 182-189

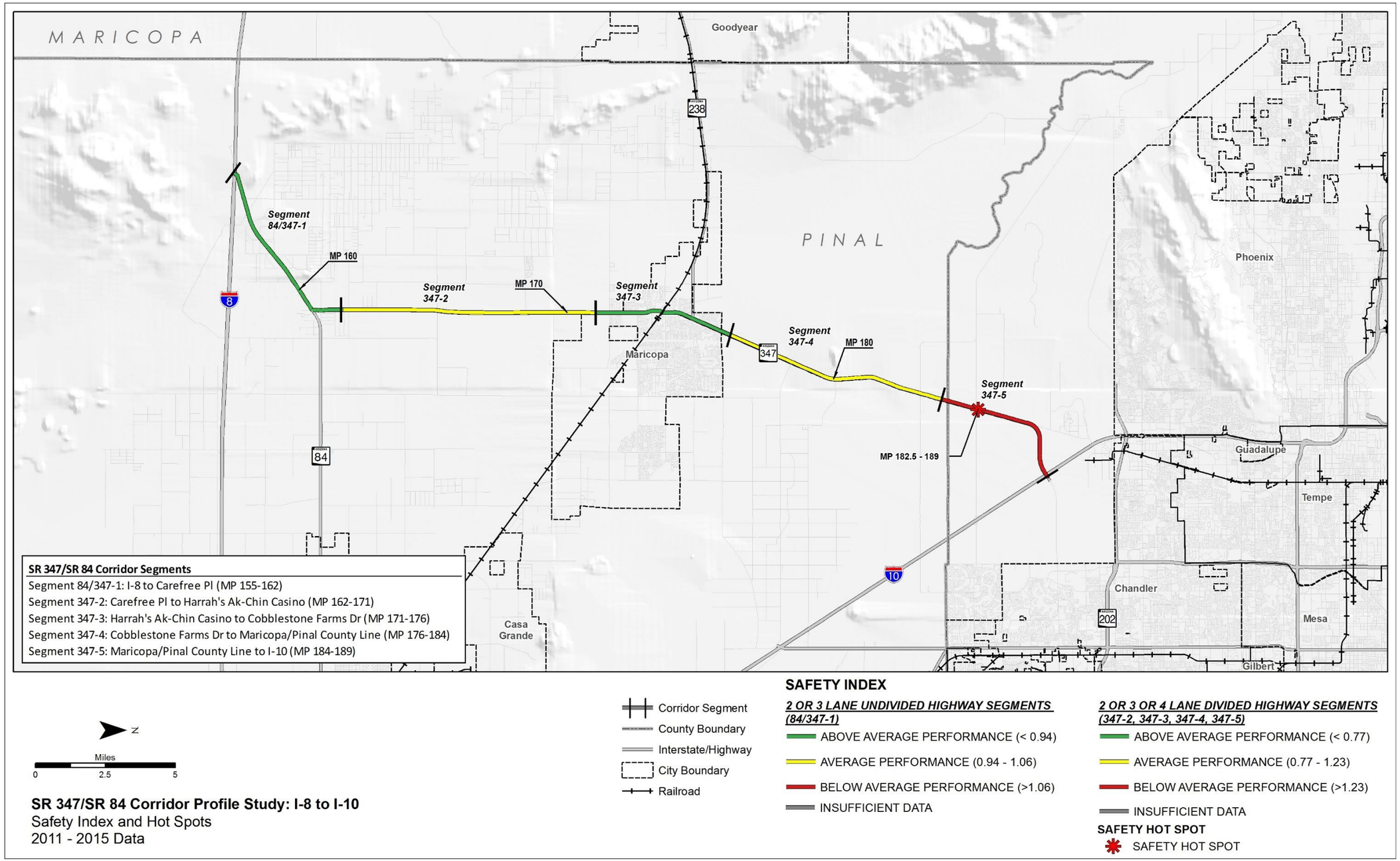
Table 8 summarizes the Safety performance results for the SR 347/SR 84 corridor. **Figure 14** illustrates the primary Safety Index performance and locations of Safety hot spots along the SR 347/SR 84 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 8: Safety Performance

Segment #	Segment Length (miles)	Total Fatal & Incapacitating Injury Crashes (F/I)	Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers
				NB/EB	SB/WB				
84/347-1[b]	7	0/2	0.34	0.00	0.68	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
347-2[a]	9	2/3	1.21	1.11	1.31	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
347-3[a]	5	0/2	0.06	0.06	0.06	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
347-4[a]	8	3/7	0.87	0.57	1.17	80%	Insufficient Data	Insufficient Data	Insufficient Data
347-5[a]	5	4/17	1.93	1.00	2.86	48%	Insufficient Data	Insufficient Data	Insufficient Data
Weighted Corridor Average			0.90	0.59	1.21	67%	Insufficient Data	Insufficient Data	Insufficient Data
SCALES									
Performance Level			**2 or 3 or 4 Lane Divided Highway**						
Above Average			< 0.77			< 44%	< 4%	< 16%	< 2%
Average			0.77 – 1.23			44% - 54%	4% - 7%	16% - 26%	2% - 4%
Below Average			> 1.23			> 54%	> 7%	> 26%	> 4%
Performance Level			**2 or 3 Lane Undivided Highway**						
Above Average			< 0.94			< 51%	< 5%	< 18%	< 2%
Average			0.94 – 1.06			51% - 58%	5% - 7%	18% - 27%	2% - 4%
Below Average			> 1.06			> 58%	> 7%	> 27%	> 4%

[a]2 or 3 or 4 Lane Divided Highway
[b]2 or 3 Lane Undivided Highway
Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings.

Figure 14: Safety Performance



2.6 Freight Performance Area

The Freight performance area consists of a single primary measure (Freight Index) and five secondary measures, as illustrated in **Figure 15**. All measures related to the reliability of truck travel as measured by observed truck travel time speed and delays to truck travel from freeway closures or physical restrictions to truck travel. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

Figure 15: Freight Performance Measures

Primary Freight Index

The Freight Index is a reliability performance measure based on the PTI for truck travel. The Truck Planning Time Index (TPTI) is the ratio of the 95th percentile truck travel time to the free-flow truck travel time. The TPTI reflects the extra buffer time needed for on-time delivery while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as crashes, inclement weather, and construction activities.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Freight performance area, the relevant operating environments are interrupted flow (e.g., signalized at-grade intersections are present) and uninterrupted flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway).

For the SR 347/SR 84 corridor, the following operating environments were identified:

- Interrupted Flow: Segments 84/347-1, 347-2, 347-3, 347-4, and 347-5

Secondary Freight Measures

The Freight performance area includes five secondary measures that provide an in-depth evaluation of the different characteristics of freight performance:

Recurring Delay (Directional Truck Travel Time Index [TTTI])

- The ratio of the average peak period truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TTTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics

Non-Recurring Delay (Directional TPTI)

- The ratio of the 95th percentile truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TPTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- The TPTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

Closure Duration

- The average time (in minutes) a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average is applied to each closure that takes into account the distance over which the closure occurs

Bridge Vertical Clearance

- The minimum vertical clearance (in feet) over the travel lanes for underpass structures on each segment

Bridge Vertical Clearance Hot Spots

- A Bridge vertical clearance “hot spot” exists where the underpass vertical clearance over the mainline travel lanes is less than 16.25 feet and no exit/entrance ramps exist to allow vehicles to bypass the low clearance location
- If a location with a vertical clearance less than 16.25 feet can be avoided by using immediately adjacent exit/entrance ramps rather than the mainline, it is not considered a hot spot

Freight Performance Results

The Freight Index provides a high-level assessment of freight mobility for the corridor and for each segment. The five secondary measures provide more detailed information to assess freight performance.

Based on the results of this analysis, the following observations were made:

- The weighted average of the Freight Index shows "fair" overall performance for the SR 347/SR 84 corridor; each of the segments shows "poor" performance with the exception of Segment 84/347-1 and Segment 347-2, which shows "good" and "fair" performance, respectively
- Many segments show "poor" performance for Directional TPTI measures with the exception of Segment 84/347-1 and Segment 347-2, meaning the corridor has mostly "poor" travel time reliability in the NB/EB and SB/WB direction due to non-recurring congestion
- Most of the segments show "good" performance in the closure duration performance measures
- No bridge vertical clearance hot spots exist along the SR 347/SR 84 corridor

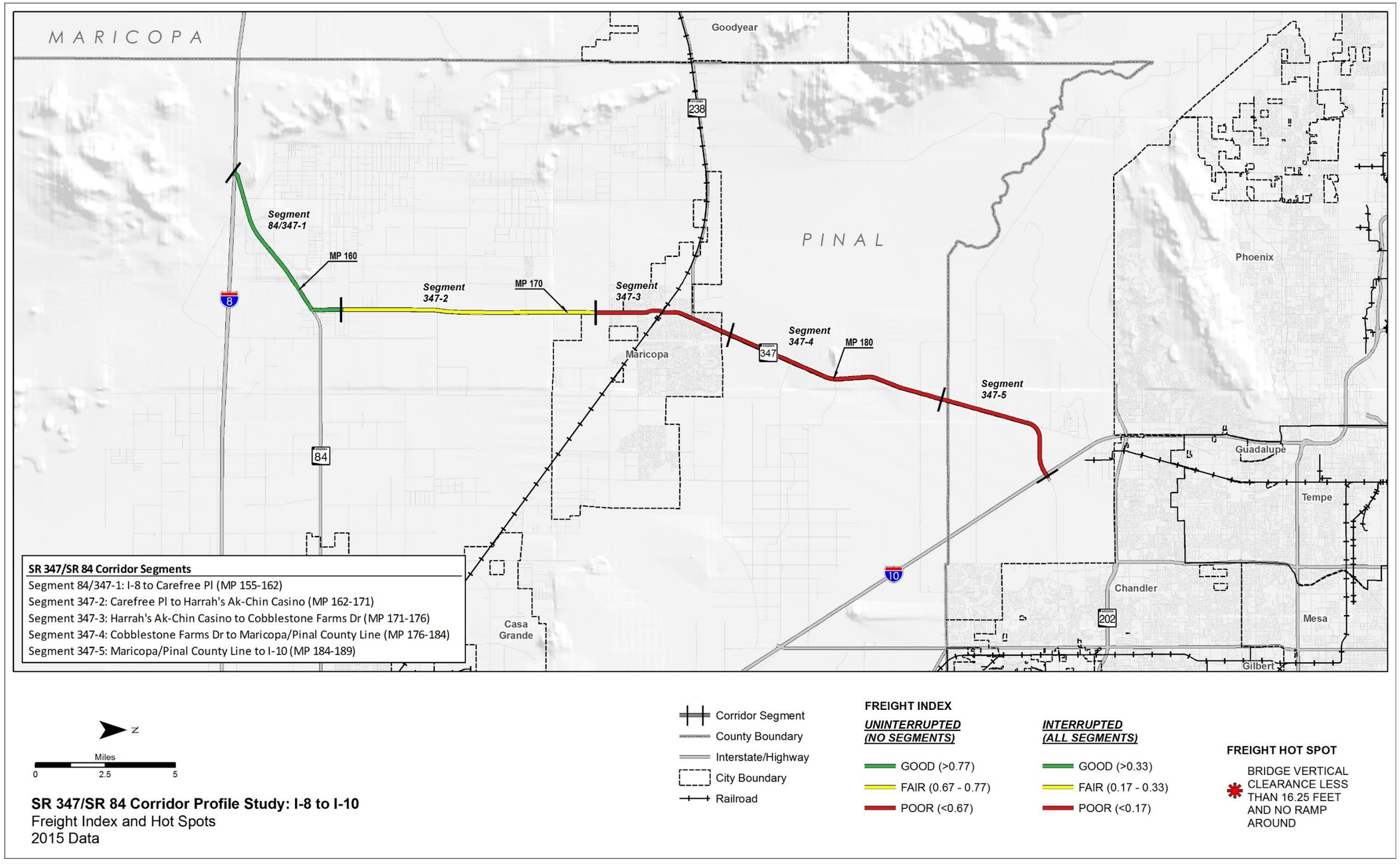
Table 9 summarizes the Freight performance results for the SR 347/SR 84 corridor. **Figure 16** illustrates the primary Freight Index performance and locations of freight hot spots along the SR 347/SR 84 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 9: Freight Performance

Segment #	Segment Length (miles)	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (minutes/ milepost/ year/mile)		Bridge Vertical Clearance (feet)
			NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	
84/347-1[2]*	7	0.45	1.02	1.14	1.94	2.50	6.34	0.00	No UP
347-2[2]*	9	0.30	1.14	1.26	3.73	3.01	13.33	24.27	No UP
347-3[1]*	5	0.11	1.50	1.58	8.00	10.06	29.16	9.40	No UP
347-4[2]*	8	0.11	1.46	1.34	10.53	7.12	40.59	20.25	No UP
347-5[2]*	5	0.14	1.42	1.30	9.18	5.13	106.80	10.96	No UP
Weighted Corridor Average		0.23	1.29	1.31	6.43	5.22	35.26	14.19	No UP
SCALES									
Performance Level		**Uninterrupted Interrupted**					**All**		
Good	> 0.77^ > 0.33*		< 1.15^ < 1.30*		< 1.30^ < 3.00*		< 44.18		> 16.5
Fair	0.67 - 0.77^ 0.17 - 0.33*		1.15 -1.33^ 1.30 - 2.00*		1.30 - 1.50^ 3.00-6.00*		44.18 -124.86		16.0 - 16.5
Poor	< 0.67^ < 0.17*		> 1.33^ > 2.00*		> 1.50^ > 6.00*		> 124.86		< 16.0

[1]Urban Operating Environment
[2]Rural Operating Environment
^Uninterrupted Flow Facility
*Interrupted Flow Facility

Figure 16: Freight Performance



2.7 Corridor Performance Summary

Based on the results presented in the preceding sections, the following general observations were made related to the performance of the SR 347/SR 84 corridor:

- Overall Performance: The Pavement and Bridge performance areas show generally "good" or "fair" performance; the Mobility, Safety, and Freight performance areas show a mix of "good/above average", "fair/average", and "poor/below average" performance
- Pavement Performance: The weighted average of the Pavement Index shows "good" overall performance for the SR 347/SR 84 corridor; Segments 84/347-1, 347-2, 347-4, and 347-5 show "good" or "fair" performance for all Pavement performance area measures
- Bridge Performance: The weighted average of the Bridge Index shows "fair" overall performance for the SR 347/SR 84 corridor; Segments 84/347-1, 347-2, 347-3, and 347-5 contain no bridges; Segment 347-4 shows "fair" performance for the Lowest Bridge Rating measure and "good" performance for the Sufficiency Rating and % of Deck Area on Functionally Obsolete Bridges measures
- Mobility Performance: The weighted average of the Mobility Index shows "fair" overall performance for the SR 347/SR 84 corridor; Segments 347-3, 347-4, and 347-5 show "poor" performance for the Mobility Index and Future Daily V/C measures; Segments 347-4 and 347-5 show "poor" performance for the Existing Peak Hour V/C measure; many segments show "fair" or "poor" performance for the Directional PTI measure
- Safety Performance: The weighted average of the Safety Index shows "average" overall performance for the SR 347/SR 84 corridor; in the 2011-2015 analysis period, there were 9 fatal crashes and 32 incapacitating injury crashes; there was "insufficient data" for crashes involving trucks, motorcycles, and non-motorized travelers, meaning there was not enough data available to generate reliable performance ratings so no values were calculated; Segments 347-4 and 347-5 show "below average" and "average" performance for crashes involving SHSP Top 5 Emphasis Areas
- Freight Performance: The weighted average of the Freight Index shows "fair" overall performance for the SR 347/SR 84 corridor; Segments 347-3, 347-4, and 347-5 show either "poor" or "fair" performance for the Freight Index, Directional TTTI, and Directional TPTI measures; Segment 347-2 shows "fair" performance for the Freight Index and Directional TPTI measures
- Lowest Performing Segments: Segments 347-3, 347-4, and 347-5 show "poor/below average" performance for many performance measures
- Highest Performing Segments: Segments 84/347-1 shows "good/above average" performance for many performance measures

Figure 17 shows the percentage of the SR 347/SR 84 corridor that rates either "good/above average" performance, "fair/average" performance, or "poor/below average" performance for each primary measure. On the SR 347/SR 84 corridor, Freight and Mobility are the lowest performing areas with 54% of the corridor in "poor" condition as it relates to the primary measures. Pavement is the highest performing area along the SR 347/SR 84 corridor with 100% of the corridor in "good" condition as it relates to the primary measure. The Bridge performance area shows "fair" performance. The Safety performance areas shows a more even mix of "above average", "average", and "below average" performance.

Table 10 shows a summary of corridor performance for all primary measures and secondary measure indicators for the SR 347/SR 84 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure. The weighted average ratings are summarized in **Figure 18** which also provides a brief description of each performance measure. **Figure 18** represents the average for the entire corridor and any given segment or location could have a higher or lower rating than the corridor average.

Figure 17: Performance Summary by Primary Measure

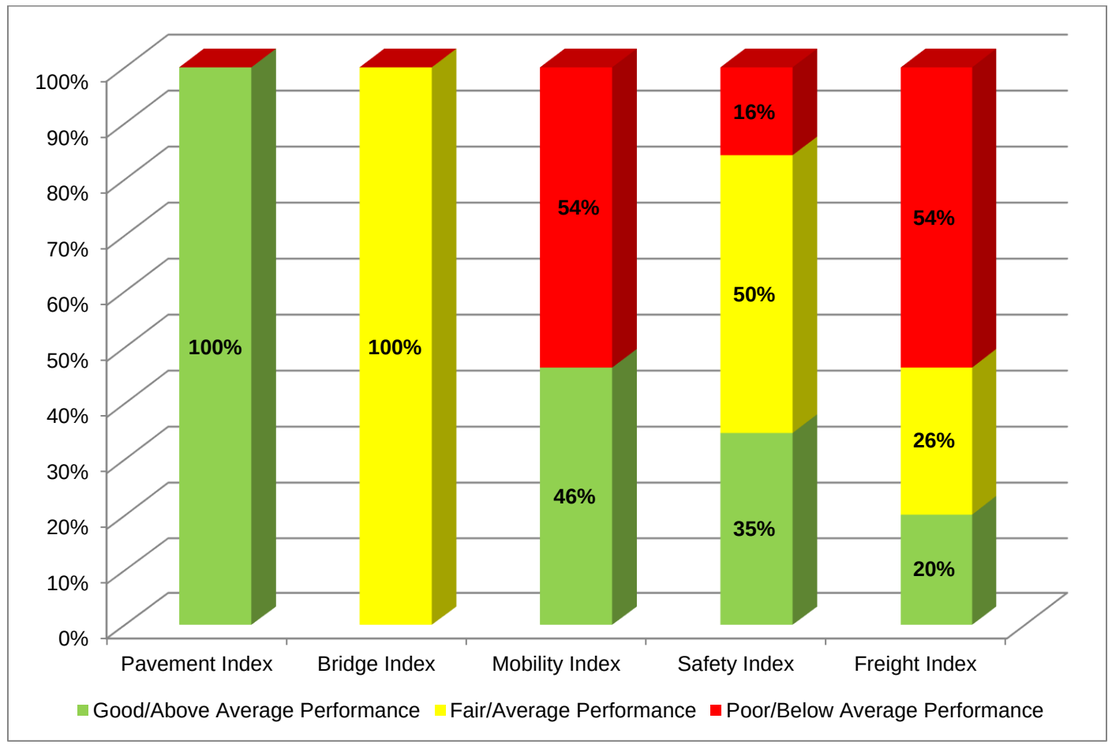


Figure 18: Corridor Performance Summary by Performance Measure

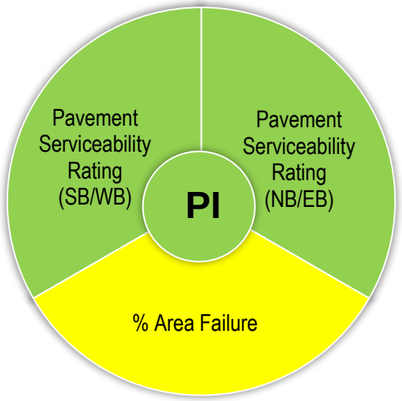
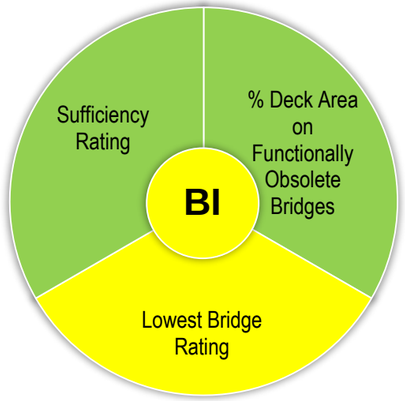
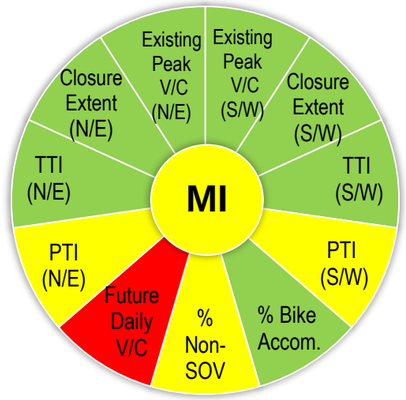
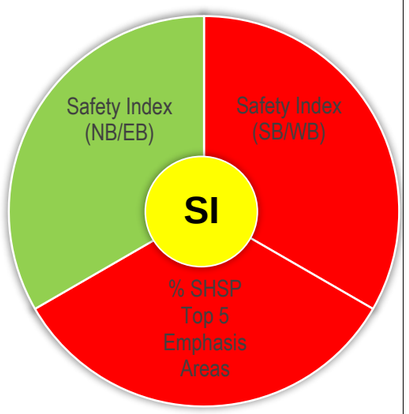
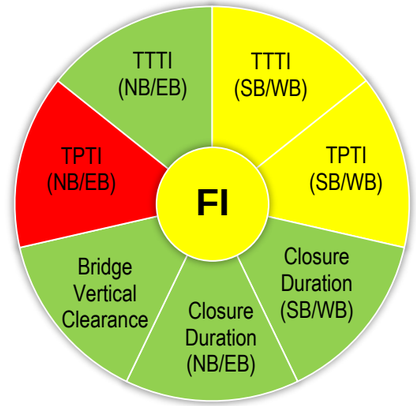
Pavement	Bridge	Mobility	Safety	Freight
				
Pavement Index (PI): based on two pavement condition ratings from the ADOT Pavement Database; the two ratings are the International Roughness Index (IRI) and the Cracking Rating	**Bridge Index (BI):** based on four bridge condition ratings from the ADOT Bridge Database; the four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating	**Mobility Index (MI):** an average of the existing daily volume-to-capacity (V/C) ratio and the projected 2035 daily V/C ratio	**Safety Index (SI):** combines the bi-directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona	**Freight Index (FI):** a reliability performance measure based on the bi-directional planning time index for truck travel
➢ **Directional Pavement Serviceability Rating (PSR)** – the weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel ➢ **% Area Failure** – the percentage of pavement area rated above failure thresholds for IRI or Cracking	➢ **Sufficiency Rating**– multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour ➢ **% of Deck Area on Functionally Obsolete Bridges**– the percentage of deck area in a segment that is on functionally obsolete bridges; identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails; a bridge that is functionally obsolete may still be structurally sound ➢ **Lowest Bridge Rating** –the lowest rating of the four bridge condition ratings on each segment	➢ **Future Daily V/C** – the future 2035 V/C ratio provides a measure of future congestion if no capacity improvements are made to the corridor ➢ **Existing Peak Hour V/C** – the existing peak hour V/C ratio for each direction of travel provides a measure of existing peak hour congestion during typical weekdays ➢ **Closure Extent** – the average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel ➢ **Directional Travel Time Index (TTI)** – the ratio of the average peak period travel time to the free-flow travel time; the TTI represents recurring delay along the corridor ➢ **Directional Planning Time Index (PTI)** – the ratio of the 95th percentile travel time to the free-flow travel time; the PTI represents non-recurring delay along the corridor ➢ **% Bicycle Accommodation** – the percentage of a segment that accommodates bicycle travel ➢ **% Non-single Occupancy Vehicle (Non-SOV) Trips** –the percentage of trips that are taken by vehicles carrying more than one occupant	➢ **Directional Safety Index** – the combination of the directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona ➢ **% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors** – the percentage of fatal and incapacitating crashes that involve at least one of the five Strategic Highway Safety Plan (SHSP) emphasis areas on a given segment compared to the statewide average percentage on roads with similar operating environments ➢ **% of Fatal + Incapacitating Crashes Involving SHSP Crash Unit Types** – the percentage of total fatal and incapacitating injury crashes that involves a given crash unit type (motorcycle, truck, non-motorized traveler) compared to the statewide average percentage on roads with similar operating environments	➢ **Directional Truck Travel Time Index (TTTI)** – the ratio of the average peak period truck travel time to the free-flow truck travel time; the TTTI represents recurring delay along the corridor ➢ **Directional Truck Planning Time Index (TPTI)** – the ratio the 95th percentile truck travel time to the free-flow truck travel time; the TPTI represents non-recurring delay along the corridor ➢ **Closure Duration** – the average time a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel ➢ **Bridge Vertical Clearance** – the minimum vertical clearance over the travel lanes for underpass structures on each segment

Table 10: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area											
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/ milepost/year/ mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
			NB/EB	SB/WB								NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB		
84/347-1^[b2]	7	4.13	4.09	4.18	0.0%	No Bridges				0.12	0.17	0.09	0.08	0.03	0.00	1.00	1.07	2.05	2.86	100%	19.9%
347-2^[a2]	9	3.86	4.07	4.23	11.1%	No Bridges				0.11	0.14	0.06	0.06	0.09	0.13	1.22	1.26	4.72	3.06	100%	20.2%
347-3*[a1]	5	3.81	3.21	3.59	29.2%	No Bridges				1.03	1.33	0.63	0.63	0.16	0.12	1.43	1.43	6.13	4.51	43%	19.1%
347-4*[a2]	8	3.95	3.86	3.95	0.0%	6.20	98.60	0.0%	6	1.47	1.75	1.01	1.03	0.24	0.15	1.24	1.19	3.25	2.24	98%	9.4%
347-5*[a2]	5	3.97	3.76	4.03	10.0%	No Bridges				1.35	1.61	0.90	0.89	0.61	0.12	1.16	1.15	3.05	2.83	98%	9.3%
Weighted Corridor Average		3.94	3.85	4.03	8.7%	6.20	98.60	0.0%	6	0.76	0.93	0.50	0.50	0.20	0.11	1.20	1.21	3.78	3.01	91%	15.7%

SCALES

Performance Level	Non-Interstate			All				Urban and Fringe Urban	All	Uninterrupted		All	
Good/Above Average Performance	> 3.50	> 3.50	< 5%	> 6.5	> 80	< 12%	> 6	< 0.71	< 0.22	< 1.15	< 1.3	> 90%	> 17%
Fair/Average Performance	2.90 - 3.50	2.90 - 3.50	5% - 20%	5.0 - 6.5	50 - 80	12% - 40%	5 - 6	0.71 - 0.89	0.22 - 0.62	1.15 - 1.33	1.3 - 1.5	60% - 90%	11% - 17%
Poor/Below Average Performance	< 2.90	< 2.90	> 20%	< 5.0	< 50	> 40%	< 5	> 0.89	> .62	> 1.33	> 1.5	< 60%	< 11%

Performance Level	Rural	Interrupted	
Good/Above Average Performance	< 0.56	< 1.3	< 3.0
Fair/Average Performance	0.56 - 0.76	> 1.3 & < 2.0	> 3.0 & < 6.0
Poor/Below Average Performance	> 0.76	> 2.0	> 6.0

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Table 10: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI		Directional TPTI		Closure Duration (minutes/milepost/year)		Bridge Vertical Clearance (feet)
			NB/EB	SB/WB						NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	
84/347-1^[b2]	7	0.34	0.00	0.68	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.45	1.02	1.14	1.94	2.50	6.34	0.00	No UP
347-2^[a2]	9	1.21	1.11	1.31	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.30	1.14	1.26	3.73	3.01	13.33	24.27	No UP
347-3*[a1]	5	0.06	0.06	0.06	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.11	1.50	1.58	8.00	10.06	29.16	9.40	No UP
347-4*[a2]	8	0.87	0.57	1.17	80%	Insufficient Data	Insufficient Data	Insufficient Data	0.11	1.46	1.34	10.53	7.12	40.59	20.25	No UP
347-5*[a2]	5	1.93	1.00	2.86	48%	Insufficient Data	Insufficient Data	Insufficient Data	0.14	1.42	1.30	9.18	5.13	106.80	10.96	No UP
Weighted Corridor Average		0.90	0.59	1.21	67%	Insufficient Data	Insufficient Data	Insufficient Data	0.23	1.29	1.31	6.43	5.22	35.26	14.19	No UP
SCALES																
Performance Level		**2 or 3 or 4 Lane Divided Highway**							**Uninterrupted**					**All**		
Good/Above Average Performance		< 0.77			< 44%	< 4%	< 16%	< 2%	> 0.77	< 1.15		< 1.3		< 44.18		> 16.5
Fair/Average Performance		0.77 - 1.23			44% - 54%	4% - 7%	16% - 26%	2% - 4%	0.67 - 0.77	1.15 - 1.33		1.3 - 1.5		44.18-124.86		16.0 - 16.5
Poor/Below Average Performance		> 1.23			> 54%	> 7%	> 26%	> 4%	< 0.67	> 1.33		> 1.5		> 124.86		< 16.0
Performance Level		**2 or 3 Lane Undivided Highway**							**Interrupted**							
Good/Above Average Performance		< 0.94			< 51%	< 5%	< 18%	< 2%	> 0.33	< 1.3		< 3.0				
Fair/Average Performance		0.94 - 1.06			51% - 58%	5% - 7%	18% - 27%	2% - 4%	0.17 - 0.33	1.3 - 2.0		3.0 - 6.0				
Poor/Below Average Performance		> 1.06			> 58%	> 7%	> 27%	> 4%	< 0.17	> 2.0		> 6.0				

^Uninterrupted Flow Facility
*Interrupted Flow Facility
[a]2 or 3 or 4 Lane Divided Highway
[b]2 or 3 Lane Undivided Highway
[1]Urban Operating Environment
[2]Rural Operating Environment

Notes: *"Insufficient Data" indicates there was not enough data available to generate reliable performance ratings*
"No UP" indicates no underpasses are present in the segment

3.0 NEEDS ASSESSMENT

3.1 Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP) goals and objectives that were updated in 2016. Statewide performance goals that are relevant to SR 347/SR 84 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three "emphasis areas" were identified for the SR 347/SR 84 corridor: Mobility, Safety, and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas. **Table 11** shows the SR 347/SR 84 corridor goals, corridor objectives, and performance objectives, and how they align with the statewide goals.

It is not reasonable within a financially constrained environment to expect that every performance measure will always be at the highest levels on every corridor segment. Therefore, individual corridor segment objectives have been set as "fair/average" or better and should not fall below that standard.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Addressing current and future congestion, thereby improving mobility on congested segments, will also help the corridor fulfill its potential as a significant contributor to the region's economy.

Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Goal achievement will improve or reduce current and future congestion, increase travel time reliability, and reduce fatalities and incapacitating injuries resulting from vehicle crashes. Where performance is currently rated "good", the goal is always to maintain that standard, regardless of whether or not the performance is in an emphasis area.

Table 11: Corridor Performance Goals and Objectives

ADOT Statewide LRTP Goals	SR 347/SR 84 Corridor Goals	SR 347/SR 84 Corridor Objectives	Performance Area	Primary Measure	Performance Objective	
				Secondary Measure Indicators	Corridor Average	Segment
Improve Mobility, Reliability, and Accessibility	Improve mobility through additional capacity and improved roadway geometry Provide a safe and reliable route for recreational and tourist travel Provide safe, reliable and efficient connection to all communities along the corridor to permit efficient regional travel Implement critical/cost-effective investments to improve access to multimodal transportation	Reduce current congestion and plan to facilitate future congestion that accounts for anticipated growth, particularly from the City of Maricopa and the nearby Phoenix metropolitan area Reduce delays from recurring and non-recurring events to improve reliability Better accommodate bicycle and pedestrian use on the state system Emphasize the deployment of technology to optimize existing system capacity and performance	Mobility (*Emphasis Area*)	Mobility Index	Good	Fair or better
				Future Daily V/C		
				Existing Peak Hour V/C		
				Closure Extent		
				Directional Travel Time Index		
				Directional Planning Time Index		
				% Bicycle Accommodation		
				% Non-SOV Trips		
Make Cost Effective Investment Decisions and Support Economic Vitality	Provide a safe, reliable and efficient freight route	Implement the most cost effective transportation solutions Reduce delays and restrictions to freight movement to improve reliability Improve travel time reliability (including impacts to motorists due to freight traffic)	Freight *(Emphasis Area)*	Freight Index	Good	Fair or better
				Directional Truck Travel Time Index		
				Directional Truck Planning Time Index		
				Closure Duration		
				Bridge Vertical Clearance		
Preserve and Maintain the System	Maintain, preserve, extend service life, and modernize State Transportation System infrastructure	Maintain structural integrity of bridges	Bridge	Bridge Index	Fair or better	Fair or better
				Sufficiency Rating		
				% of Deck Area on Functionally Obsolete Bridges		
				Lowest Bridge Rating		
		Improve pavement ride quality for all corridor users Reduce long-term pavement maintenance costs	Pavement	Pavement Index	Fair or better	Fair or better
				Directional Pavement Serviceability Rating		
				% Area Failure		
Enhance Safety	Provide a safe, reliable, and efficient connection for the communities along the corridor Improve transportation system safety for all modes	Reduce the number and rate of fatal and incapacitating injury crashes for all roadway users	Safety *(Emphasis Area)*	Safety Index	Above Average	Average or better
				Directional Safety Index		
				% of Crashes Involving SHSP Top 5 Emphasis Areas Behaviors		
				% of Crashes Involving Crash Unit Types		

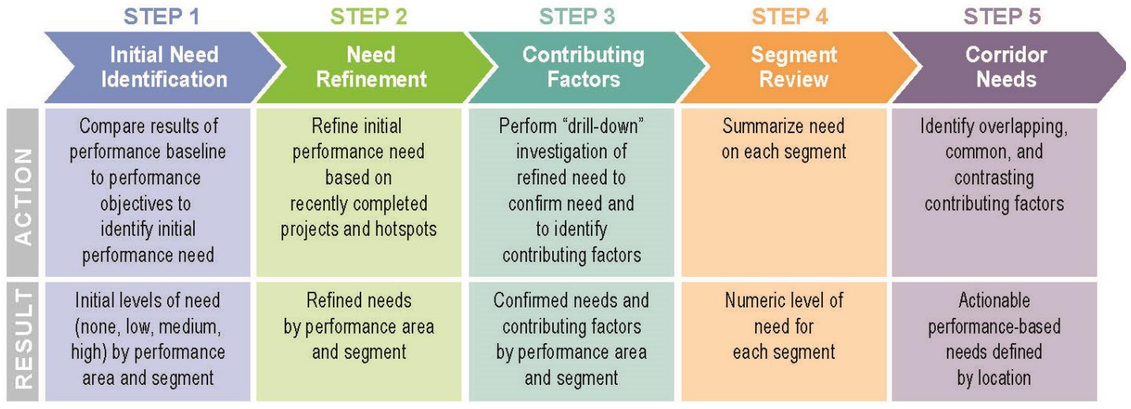
3.2 Needs Assessment Process

The following guiding principles were used as an initial step in developing a framework for the performance-based needs assessment process:

- Corridor needs are defined as the difference between the corridor performance and the performance objectives
- The needs assessment process should be systematic, progressive, and repeatable, but also allow for engineering judgment where needed
- The process should consider all primary and secondary performance measures developed for the study
- The process should develop multiple need levels including programmatic needs for the entire length of the corridor, performance area-specific needs, segment-specific needs, and location-specific needs (defined by MP limits)
- The process should produce actionable needs that can be addressed through strategic investments in corridor preservation, modernization, and expansion

The performance-based needs assessment process is illustrated in **Figure 19** and described in the following sections.

Figure 19: Needs Assessment Process



Step 1: Initial Needs Identification

The first step in the needs assessment process links baseline (existing) corridor performance with performance objectives. In this step, the baseline corridor performance is compared to the performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown below in **Figure 20**.

Figure 20: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
5.0	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. Values of 0, 1, 2, and 3 are assigned to the initial need levels of None, Low, Medium, and High, respectively. A weight of 1.0 is applied to the Performance Index need and equal weights of 0.20 are applied to each need for each secondary performance measure. For directional secondary performance measures, each direction of travel receives a weight of 0.10.

Step 2: Need Refinement

In Step 2, the initial level of need for each segment is refined using the following information and engineering judgment:

- For segments with an initial need of None that contain hot spots, the level of need should be increased from None to Low
- For segments with an initial level of need where recently completed projects or projects under construction are anticipated to partially or fully address the identified need, the level of need should be reduced or eliminated as appropriate
- Programmed projects that are expected to partially or fully address an identified need are not justification to lower the initial need because the programmed projects may not be

implemented as planned; in addition, further investigations may suggest that changes in the scope of a programmed project may be warranted

The resulting final needs are carried forward for further evaluation in Step 3.

Step 3: Contributing Factors
In Step 3, a more detailed review of the condition and performance data available from ADOT is conducted to identify contributing factors to the need. Typically, the same databases used to develop the baseline performance serve as the principal sources for the more detailed analysis. However, other supplemental databases may also be useful sources of information. The databases used for diagnostic analysis are listed below:

Pavement Performance Area

- Pavement Rating Database

Bridge Performance Area

- ABISS

Mobility Performance Area

- Highway Performance Monitoring System (HPMS) Database
- AZTDM
- Real-time traffic conditions data produced by American Digital Cartography Inc. (HERE) Database
- Highway Conditions Reporting System (HCRS) Database

Safety Performance Area

- Crash Database

Freight Performance Area

- HERE Database
- HCRS Database

In addition, other sources considered helpful in identifying contributing factors are:

- Maintenance history (from ADOT PeCoS database for pavement), the level of past investments, or trends in historical data that provide context for pavement and bridge history
- Field observations from ADOT district personnel can be used to provide additional information regarding a need that has been identified
- Previous studies can provide additional information regarding a need that has been identified

Step 3 results in the identification of performance-based needs and contributing factors by segment (and MP locations, if appropriate) that can be addressed through investments in preservation, modernization, and expansion projects to improve corridor performance. See **Appendix D** for more information.

Step 4: Segment Review
In this step, the needs identified in Step 2 and refined in Step 3 are quantified for each segment to numerically estimate the level of need for each segment. Values of 0 to 3 are assigned to the final need levels (from Step 3) of None, Low, Medium, and High, respectively. A weighting factor is applied to the performance areas identified as emphasis areas and a weighted average need is calculated for each segment. The resulting average need score can be used to compare levels of need between segments within a corridor and between segments in different corridors.

Step 5: Corridor Needs
In this step, the needs and contributing factors for each performance area are reviewed on a segment-by-segment basis to identify actionable needs and to facilitate the formation of solution sets that address multiple performance areas and contributing factors. The intent of this process is to identify overlapping, common, and contrasting needs to help develop strategic solutions. This step results in the identification of corridor needs by specific location.

3.3 Corridor Needs Assessment

This section documents the results of the needs assessment process described in the prior section. The needs in each performance area were classified as either None, Low, Medium, or High based on how well each segment performed in the existing performance analysis. The needs for each segment were numerically combined to estimate the average level of need for each segment of the corridor

The final needs assessments for each performance measure, along with the scales used in analysis, are shown in **Table 12** through **Table 16**.

Pavement Needs Refinement and Contributing Factors

- The level of need in Segment 347-5 was increased from None to Low due to the presence of a hot spot
- There are two segments along the corridor, Segment 347-3 and 347-4, that have potential pavement repetitive historical investment issues
- See **Appendix D** for detailed information on contributing factors

Table 12: Final Pavement Needs

Segment #	Performance Score and Level of Need				Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Pavement Index	Directional PSR		% Area Failure				
		NB/EB	SB/WB					
84/347-1	4.13	4.09	4.18	0%	0.00	None	None	None
347-2	3.86	4.07	4.23	11%	0.20	NB MP 162-164	None	Low
347-3	3.81	3.21	3.59	29%	0.70	NB MP 173-175	None	Low
347-4	3.95	3.86	3.95	0%	0.00	None	None	None
347-5	3.97	3.76	4.03	10%	0.00	NB MP 185-186	None	Low

Level of Need (Score)	Performance Score Need Scale		Segment Level Need Scale
None* (0)	> 3.30	< 10%	0
Low (1)	3.10 - 3.30	10% - 15%	< 1.5
Medium (2)	2.70 - 3.10	15% - 25%	1.5 - 2.5
High (3)	< 2.70	> 25%	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Bridge Needs Refinement and Contributing Factors

- No changes were made to the level of need to account for hot spots or recently completed projects
- There are no bridges along the corridor with potential historical investment issues
- See **Appendix D** for detailed information on contributing factors

Table 13: Final Bridge Needs

Segment #	Performance Score and Level of Need				Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Bridge Index	Sufficiency Rating	% of Deck on Functionally Obsolete Bridges	Lowest Bridge Rating				
84/347-1	No Bridges				0.0	None	None	None
347-2	No Bridges				0.0	None	None	None
347-3	No Bridges				0.0	None	None	None
347-4	6.20	98.60	0.00%	6.00	0.0	None	None	None
347-5	No Bridges				0.0	None	None	None

Level of Need (Score)	Performance Score Need Scale				Segment Level Need Scale
None (0)	> 6.0	> 70	> 5.0	< 21.0%	0
Low (1)	5.5 - 6.0	60 - 70	5.0	21.0% - 31.0%	< 1.5
Medium (2)	4.5 - 5.5	40 - 60	4.0	31.0% - 49.0%	1.5 - 2.5
High (3)	< 4.5	< 40	< 4.0	> 49.0%	> 2.5

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Mobility Needs Refinement and Contributing Factors

- No changes were made to the level of need to account for recently completed projects
- See **Appendix D** for detailed information on contributing factors

Table 14: Final Mobility Needs

Segment	Performance Score and Level of Need											Initial Segment Need	Recently Completed Projects	Final Segment Need
	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent		Directional TTI		Directional PTI		% Bicycle Accommodation			
			NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB				
84/347-1	0.12	0.17	0.09	0.08	0.03	0.00	1.00	1.07	2.05	2.86	100%	0.0	None	None
347-2	0.11	0.14	0.06	0.06	0.09	0.13	1.22	1.26	4.72	3.06	100%	0.1	None	Low
347-3	1.03	1.33	0.63	0.63	0.16	0.12	1.43	1.43	6.13	4.51	43%	4.5	None	High
347-4	1.47	1.75	1.01	1.03	0.24	0.15	1.24	1.19	3.25	2.24	98%	4.2	None	High
347-5	1.35	1.61	0.90	0.89	0.61	0.12	1.16	1.15	3.05	2.83	98%	4.4	None	High
Level of Need (Score)	**Performance Score Need Scale**											**Segment Level Need Scale**		
None* (0)	≤ 0.77 (Urban) ≤ 0.63 (Rural)				< 0.35		< 1.21[a] < 1.53[b]		< 1.37[a] < 4.00[b]		> 80%	0		
Low (1)	0.77 - 0.83 (Urban) 0.63 - 0.69 (Rural)				0.35 - 0.49		1.21 - 1.27[a] 1.53 - 1.77[b]		1.37 - 1.43[a] 4.00 - 5.00[b]		70% - 80%	< 1.5		
Medium (2)	0.83 - 0.95 (Urban) 0.69 - 0.83 (Rural)				0.49 - 0.75		1.27 - 1.39[a] 1.77 - 2.23[b]		1.43 - 1.57[a] 5.00 - 7.00[b]		50% - 70%	1.5 - 2.5		
High (3)	≥ 0.95 (Urban) ≥ 0.83 (Rural)				> 0.75		> 1.39[a] > 2.23[b]		> 1.57[a] > 7.00[b]		< 50%	> 2.5		

a: Uninterrupted
b: Interrupted

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Safety Needs Refinements and Contributing Factors

- No changes were made to the level of need to account for hot spots
- There are a few recently completed projects in Segment 347-3 but the initial safety need was none so no changes were made to the level of need
- See **Appendix D** for detailed information on contributing factors

Table 15: Final Safety Needs

Segment	Performance Score and Level of Need							Initial Segment Need	Hot Spots	Recently Completed Projects	Final Segment Need
	Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Area Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers				
		NB/EB	SB/WB								
84/347-1[b]	0.34	0.00	0.68	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	None	None	None
347-2[a]	1.21	1.11	1.31	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.4	None	None	Medium
347-3[a]	0.06	0.06	0.06	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.0	None	None	None
347-4[a]	0.87	0.57	1.17	80%	Insufficient Data	Insufficient Data	Insufficient Data	0.8	MP 182-184	None	Low
347-5[a]	1.93	1.00	2.86	48%	Insufficient Data	Insufficient Data	Insufficient Data	3.6	MP 184-189	None	High

Level of Need (Score)		Performance Score Needs Scale					Segment Level Need Scale
None* (0)	a b	≤ 0.92 ≤ 0.98	≤ 47% ≤ 53%	≤ 5% ≤ 6%	≤ 19% ≤ 22%	≤ 3% ≤ 3%	0
Low (1)	a b	0.92 - 1.07 0.98 - 1.02	47% - 50% 53% - 55%	5% - 6% 6% - 7%	19% - 22% 22% - 25%	3% - 4% 3% - 4%	≤ 1.5
Medium (2)	a b	1.07 - 1.38 1.02 - 1.10	50% - 57% 55% - 59%	6% - 8% 7% - 8%	22% - 29% 25% - 30%	4% - 5% 4% - 5%	1.5 - 2.5
High (3)	a b	≥ 1.38 ≥ 1.10	≥ 57% ≥ 59%	≥ 8% ≥ 8%	≥ 29% ≥ 30%	≥ 5% ≥ 5%	≥ 2.5

a: 2 or 3 or 4 Lane Divided Highway
b: 2 or 3 Lane Undivided Highway

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Freight Needs Refinements and Contributing Factors

- No changes were made to the level of need to account for hot spots as there are no bridge vertical clearance hot spots on the corridor
- The project under construction in Segment 347-3 does not substantially affect the overall segment performance so no changes were made to the level of need
- See **Appendix D** for detailed information on contributing factors

Table 16: Final Freight Needs

Segment	Performance Score and Level of Need								Initial Segment Need	Hot Spots	Recently Completed/Under Construction Projects	Final Segment Need
	Freight Index	Directional TTTI		Directional TPTI		Closure Duration		Bridge Vertical Clearance				
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB					
84/347-1[b]	0.45	1.02	1.14	1.94	2.50	6.34	0.00	No UP	0.0	None	None	None
347-2[b]	0.30	1.14	1.26	3.73	3.01	13.33	24.27	No UP	0.0	None	None	None
347-3[b]	0.11	1.50	1.58	8.00	10.06	29.16	9.40	No UP	3.7	None	Grade separated railroad crossing with bike lanes and sidewalks (2017)	High
347-4[b]	0.11	1.46	1.34	10.53	7.12	40.59	20.25	No UP	3.6	None	None	High
347-5[b]	0.14	1.42	1.30	9.18	5.13	106.80	10.96	No UP	2.7	None	None	High

Level of Need (Score)		Performance Score Need Scale					Segment Level Need Scale
None* (0)	a b	≥ 0.74 ≥ 0.28	≤ 1.21 ≤ 1.53	≤ 1.37 ≤ 4.00	≤ 71.07	≥ 16.33	0
Low (1)	a b	0.70 - 0.74 0.22 – 0.28	1.21 - 1.27 1.53 - 1.77	1.37 - 1.43 4.00 - 5.00	71.07 - 97.97	16.17 - 16.33	≤ 1.5
Medium (2)	a b	0.64 - 0.70 0.12 – 0.22	1.27 - 1.39 1.77 - 2.23	1.43 - 1.57 5.00 - 7.00	97.97 - 151.75	15.83 - 16.17	1.5 - 2.5
High (3)	a b	≤ 0.64 ≤ 0.12	≥ 1.39 ≥ 2.23	≥ 1.57 ≥ 7.00	≥ 151.75	≤ 15.83	≥ 2.5

a: Uninterrupted Flow
b: Interrupted Flow

**A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Segment Review

The needs for each segment were combined to numerically estimate the average level of need for each segment of the corridor. **Table 17** provides a summary of needs for each segment across all performance areas, with the average need score for each segment presented in the last row of the table. A weighting factor of 1.5 is applied to the need scores of the performance areas identified as emphasis areas (Mobility, Safety, and Freight for the SR 347/SR 84 corridor). There is one segment with a High average need, two segments with a Medium average need, one segment with a Low average need, and two segments with no average need.

Table 17: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)				
	84/347-1	**347-2**	**347-3**	**347-4**	**347-5**
	MP 155-162	**MP 162-171**	**MP 171-176**	**MP 176-184**	**MP 184-189**
Pavement	None	Low	Low	None	Low
Bridge	None	None	None	None	None
Mobility*	None	Low	High	High	High
Safety*	None	Medium	None	Low	High
Freight*	None	None	High	High	High
Average Need	**0.00**	**0.85**	**1.54**	**1.62**	**2.23**

* Identified as Emphasis Areas for SR 347/SR 84 Corridor
[#] N/A indicates insufficient or no data available to determine level of need
[+] A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Level of Need	Average Need Range
None[+]	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

Summary of Corridor

The needs in each performance area are shown in **Figure 21** and summarized below:

Pavement Needs

- Three segments (347-2, 347-3, and 347-5) contain Pavement hot spots
- Segments 347-2, 347-3, and 347-5 have final segment needs of Low while Segments 84/347-1 and 347-4 have a final segment need of None
- Segments 347-3 and 347-4 have potential pavement repetitive historical investment issues

Bridge Needs

- No segments along the corridor have Bridge hot spots or potential repetitive historical investment issues
- No bridges are considered functionally obsolete or structurally deficient along the corridor
- All segments along the corridor have a final segment need of None

Mobility Needs

- Segments 347-3, 347-4, and 347-5 have a final segment need of High; all other segments on the corridor have a final segment need of Low or None
- Mobility needs are primarily related to high existing and projected traffic volumes and high PTI values

Safety Needs

- Segments 347-5 and 347-2 have final segment needs of High and Medium, respectively
- Safety hot spots exist in Segments 347-4 and 347-5

Freight Needs

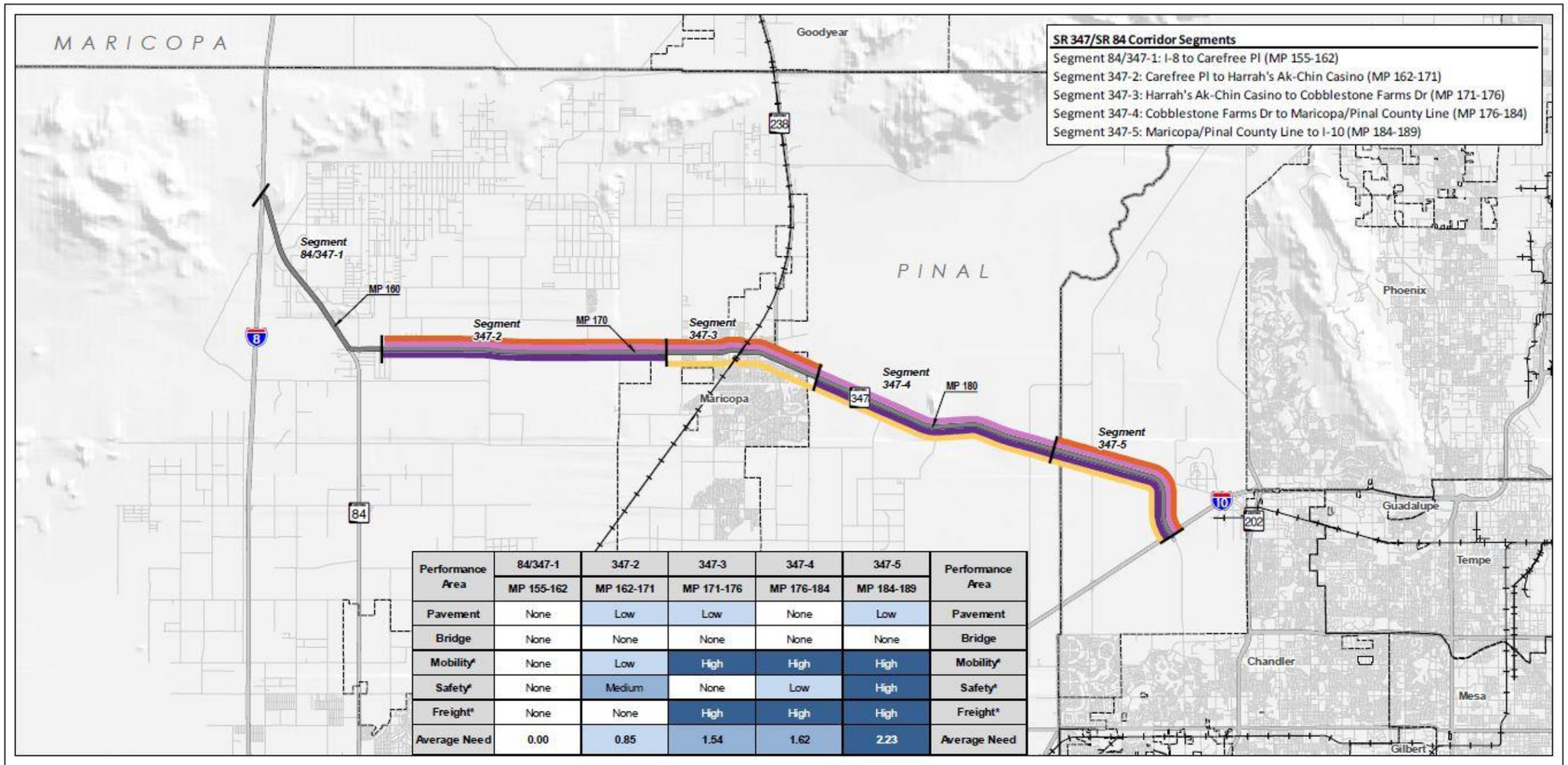
- No Freight hot spots exist along the corridor
- Segments 347-3, 347-4, and 347-5 have a final segment need of High while Segments 347-2 and 84/347-1 have a final segment need of None
- Freight needs are primarily related to high truck PTI

Overlapping Needs

This section identifies overlapping performance needs on the SR 347/SR 84 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need (i.e., Medium or High). Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Segment 347-5, which has the highest average need score of all the segments of the corridor, has elevated needs in Mobility, Safety, and Freight performance areas
- Segments 347-3 and 347-4 contains elevated needs in the Mobility and Freight performance areas

Figure 21 Corridor Needs Summary



Performance Area	84/347-1	347-2	347-3	347-4	347-5	Performance Area
	MP 155-162	MP 162-171	MP 171-176	MP 176-184	MP 184-189	
Pavement	None	Low	Low	None	Low	Pavement
Bridge	None	None	None	None	None	Bridge
Mobility*	None	Low	High	High	High	Mobility*
Safety*	None	Medium	None	Low	High	Safety*
Freight*	None	None	High	High	High	Freight*
Average Need	0.00	0.85	1.54	1.62	2.23	Average Need

* Identified as Emphasis Areas for SR 347/SR 84 Corridor
# N/A indicates insufficient or no data available to determine level of need
⁺ A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study

Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad

Performance Area Needs
Pavement
Mobility
Safety
Freight
Bridge

Level of Need	Average Need
None⁺	< 0.1
Low	0.1 - 1.0
Medium	1.0 - 2.0
High	> 2.0

SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Needs Summary

Appendix A: Corridor Performance Maps

This appendix contains maps of each primary and secondary measure associated with the five performance areas for the SR 347/SR 84 corridor. The following are the areas and maps included:

Pavement Performance Area:

- Pavement Index and Hot Spots
- Pavement Serviceability (directional)
- Percentage of Pavement Area Failure

Bridge Performance Area:

- Bridge Index and Hot Spots
- Bridge Sufficiency
- Percent of Deck Area on Functionally Obsolete Bridges
- Lowest Bridge Rating

Mobility Performance Area:

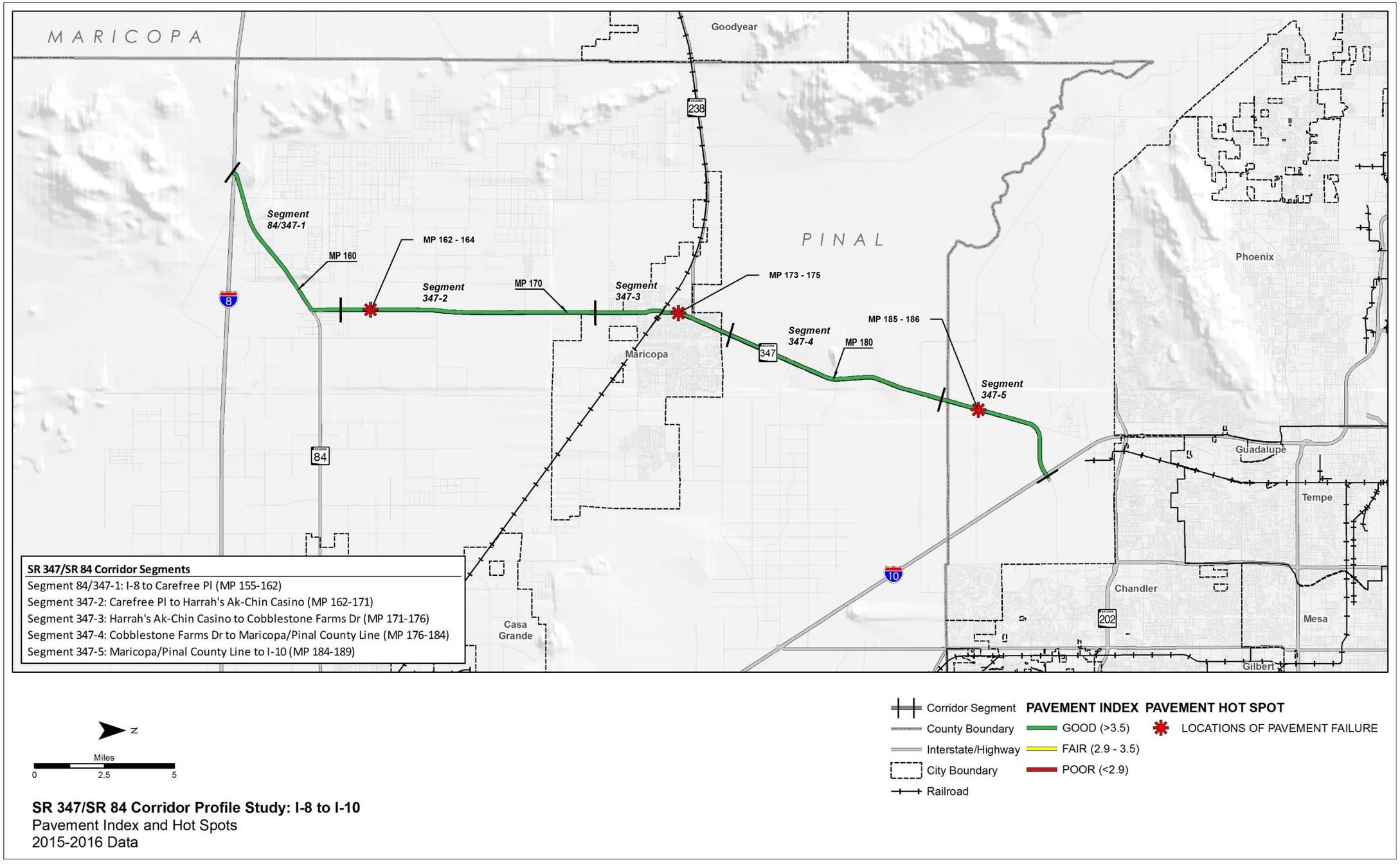
- Mobility Index
- Future Daily V/C
- Existing Peak V/C (directional)
- Average Instances Per Year a Given Milepost is Closed Per Segment Mile
- All Vehicles Travel Time Index
- All Vehicles Planning Time Index
- Multimodal Opportunities
- Percentage of Bicycle Accommodation

Safety Performance Area:

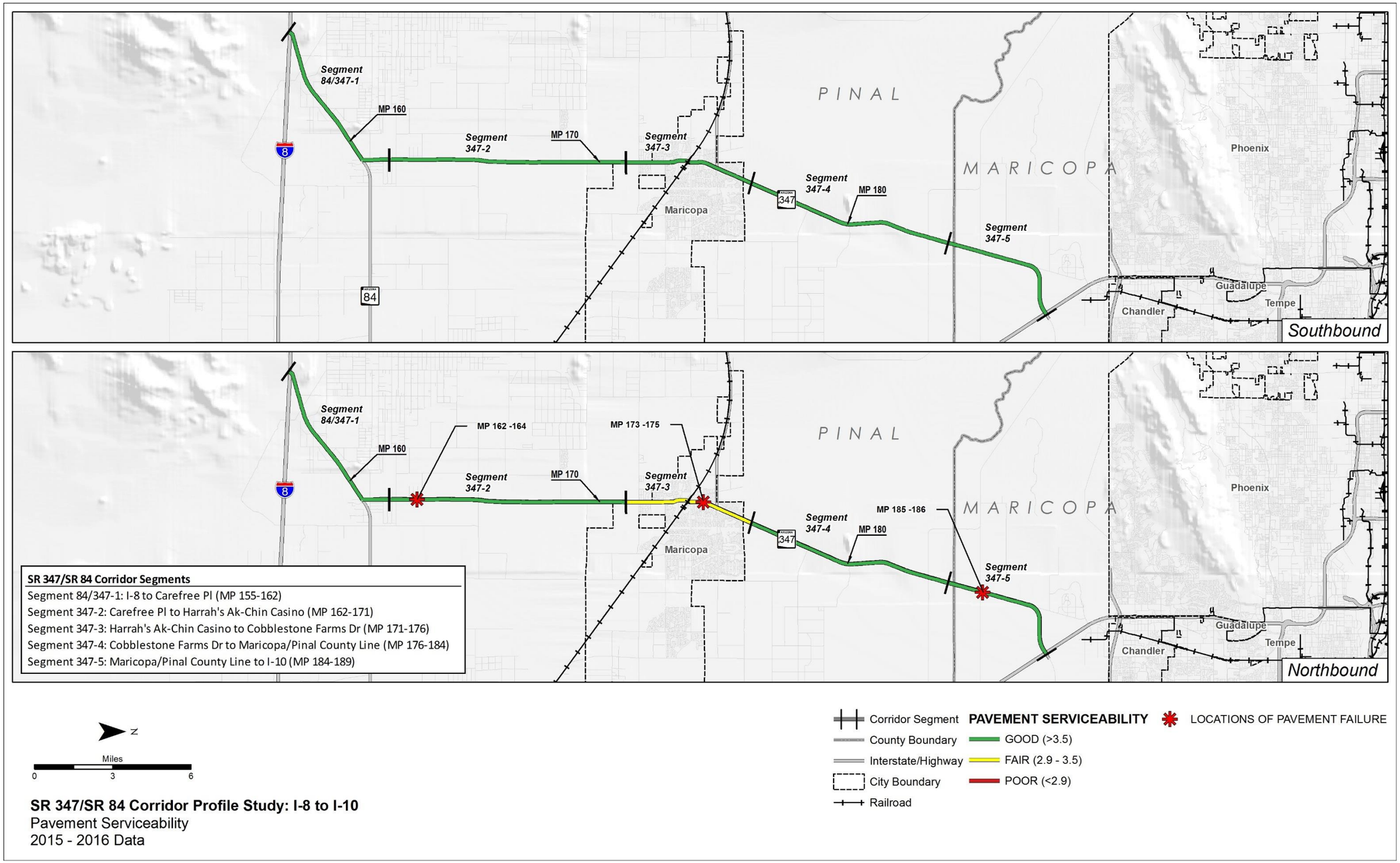
- Safety Index and Hot Spots
- Safety Index and Hot Spots (directional)
- Relative Frequency of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors Compared to the Statewide Average for Similar Segments

Freight Performance Area:

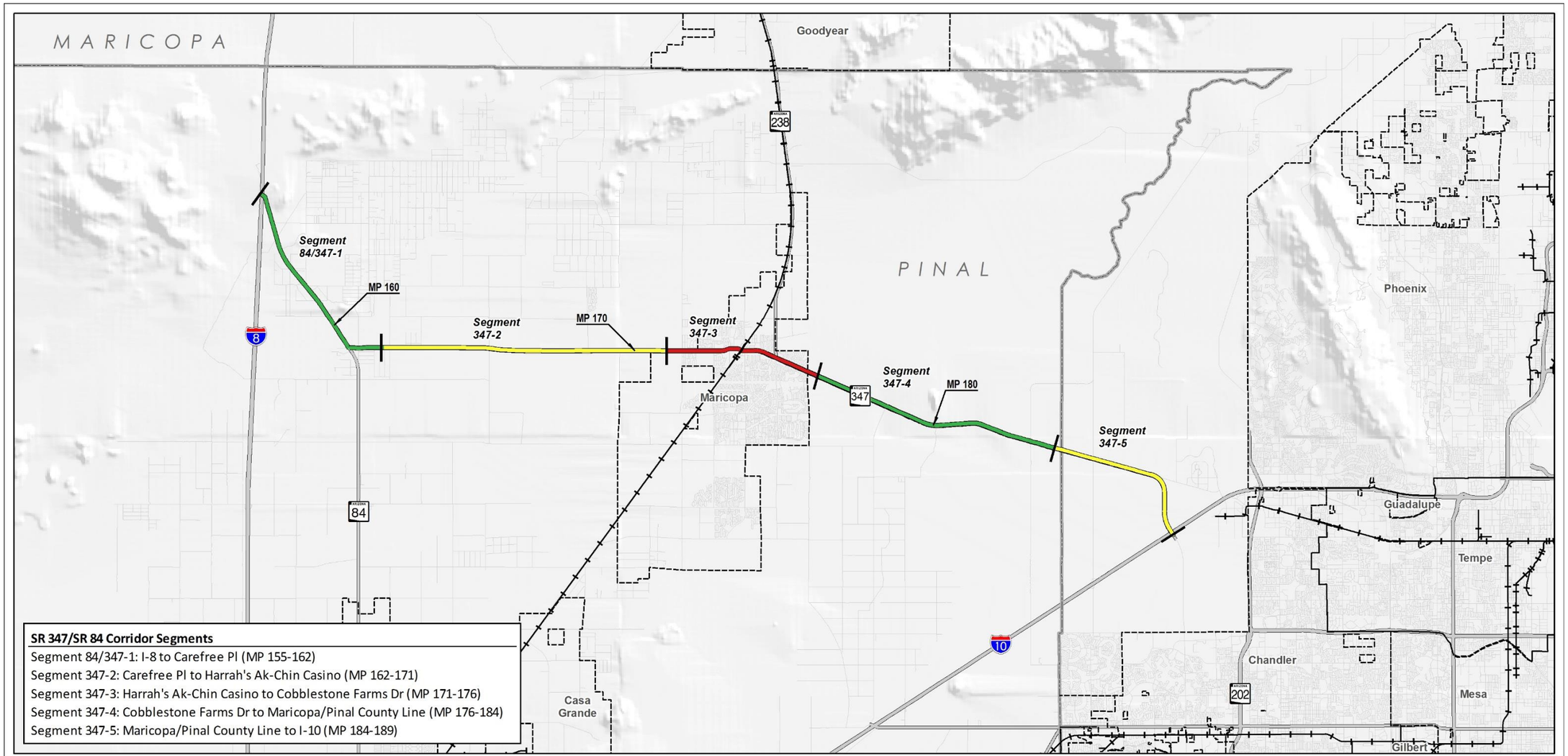
- Freight Index and Hot Spots
- Truck Travel Time Index
- Truck Planning Time Index
- Average Minutes Per Year Given Milepost is Closed Per Segment Mile
- Bridge Vertical Clearance



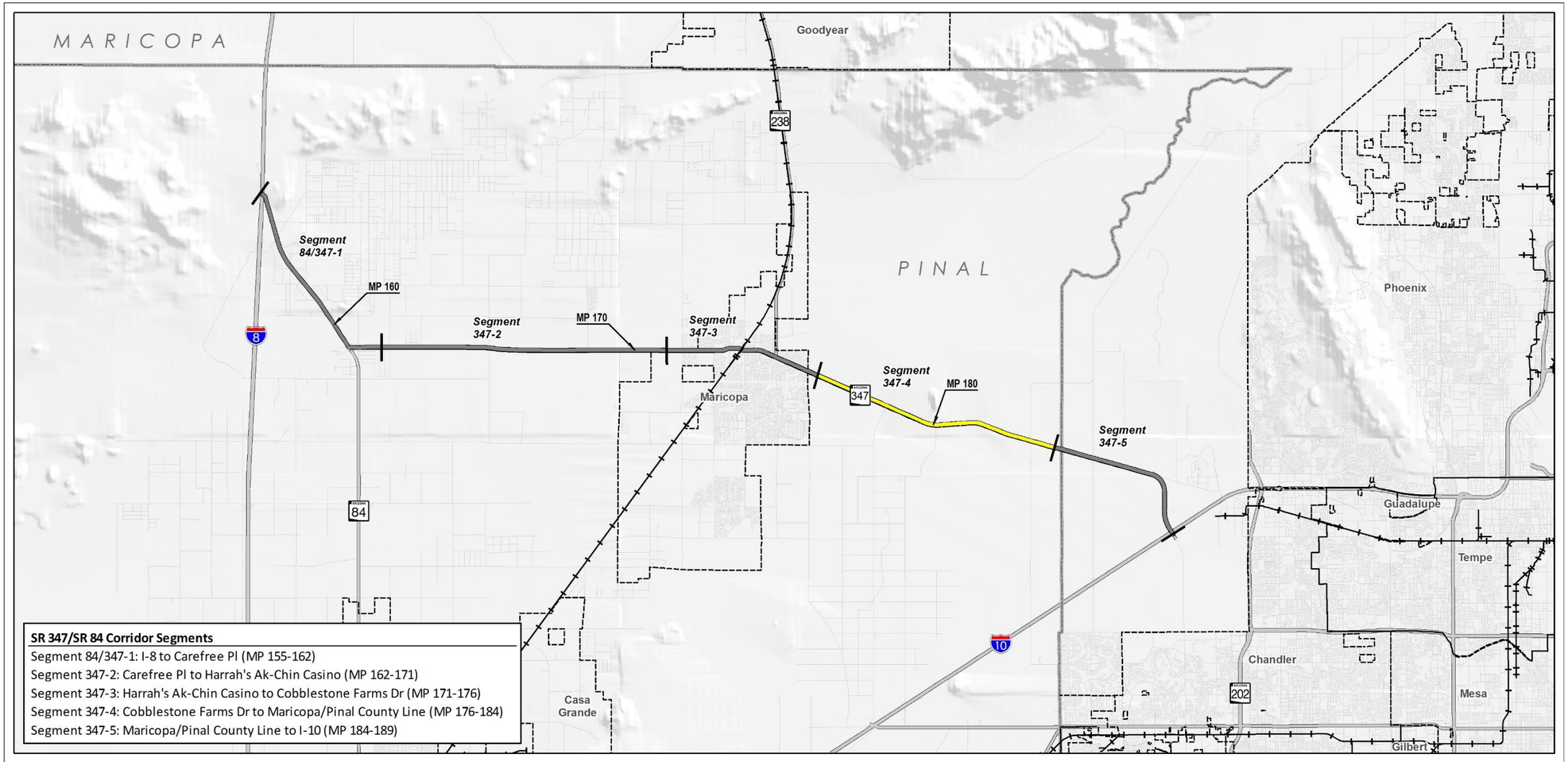
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Pavement Index and Hot Spots
2015-2016 Data



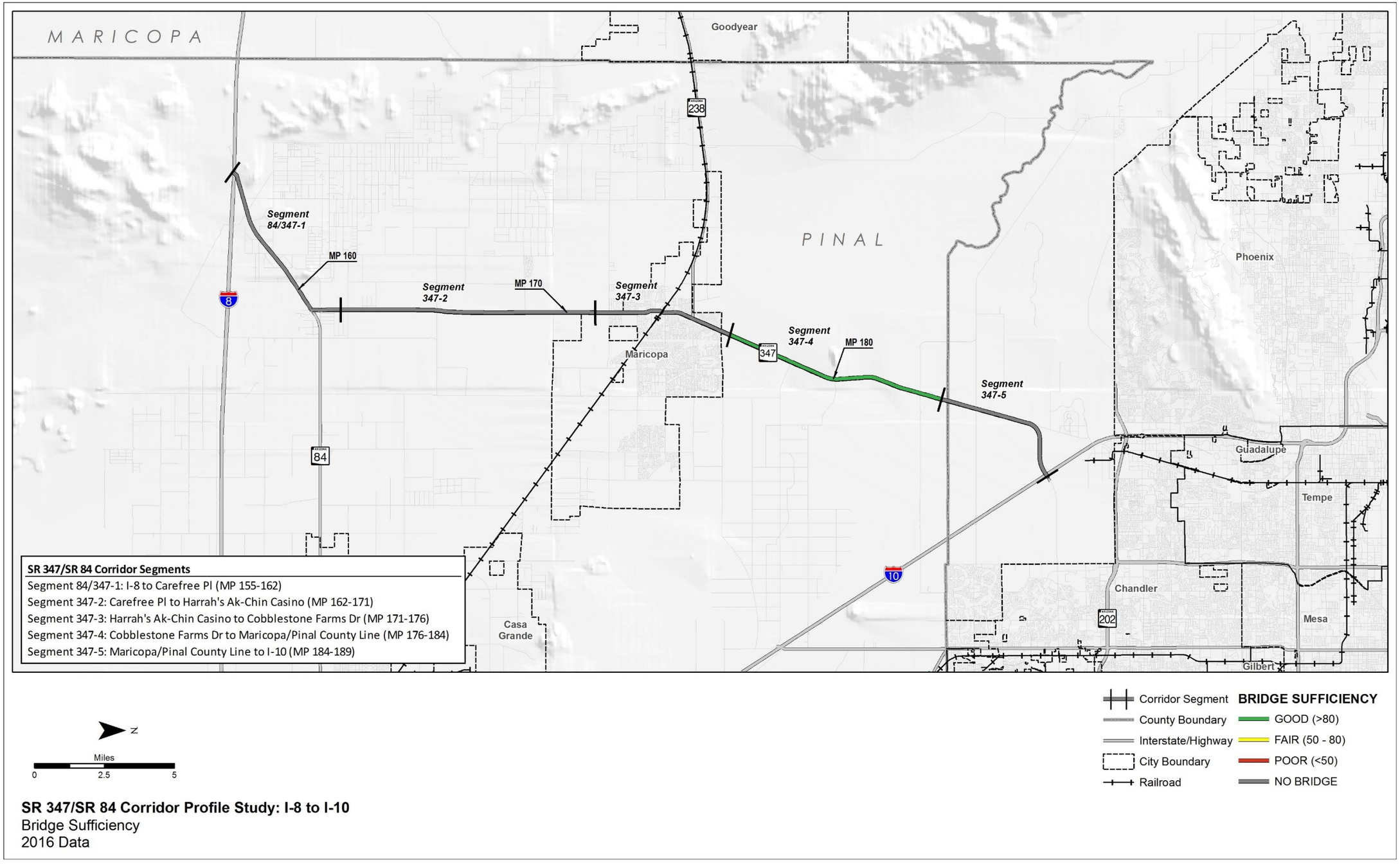
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Pavement Serviceability
2015 - 2016 Data



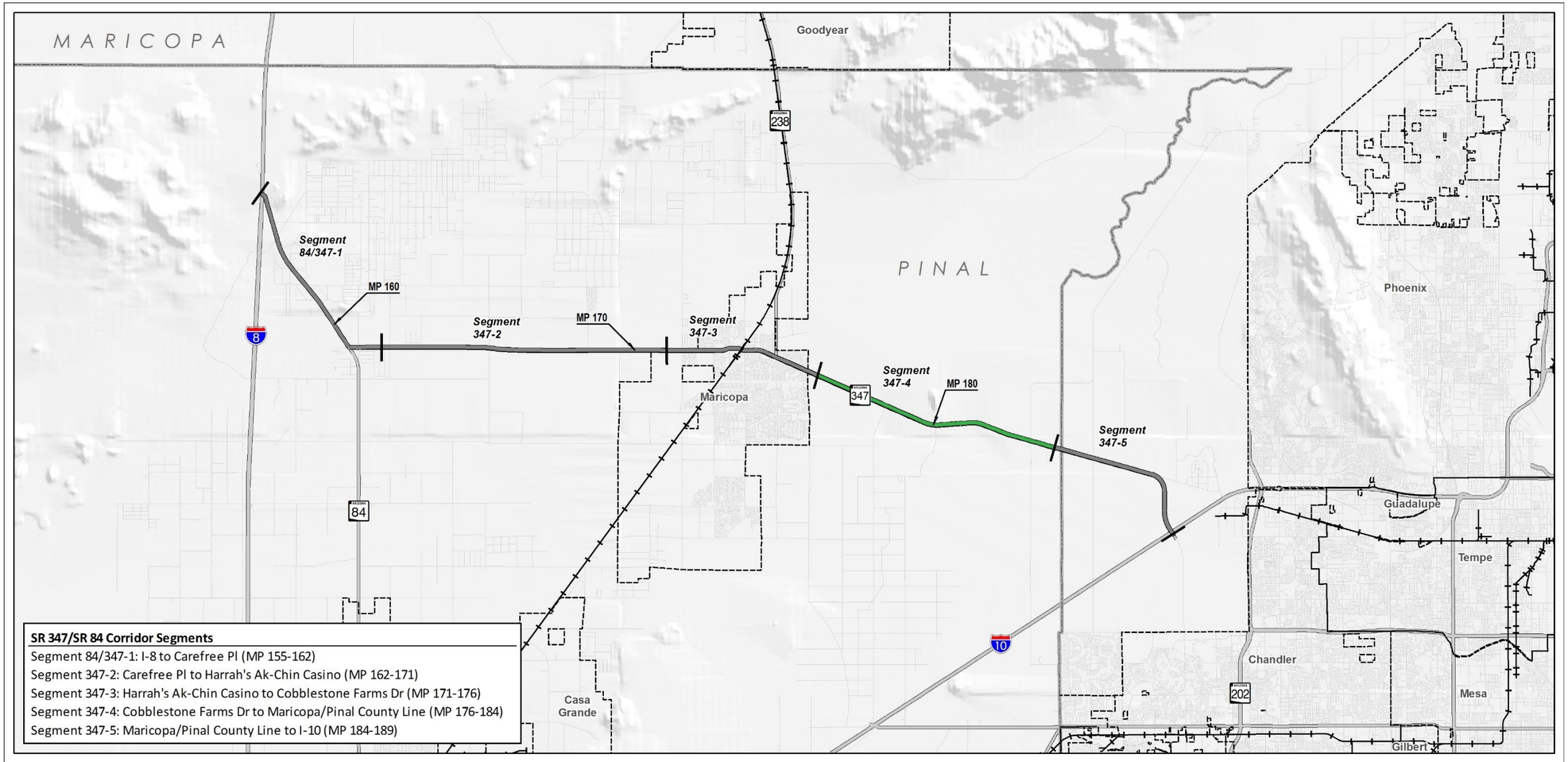
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Percentage of Pavement Area Failure
2015 - 2016 Data



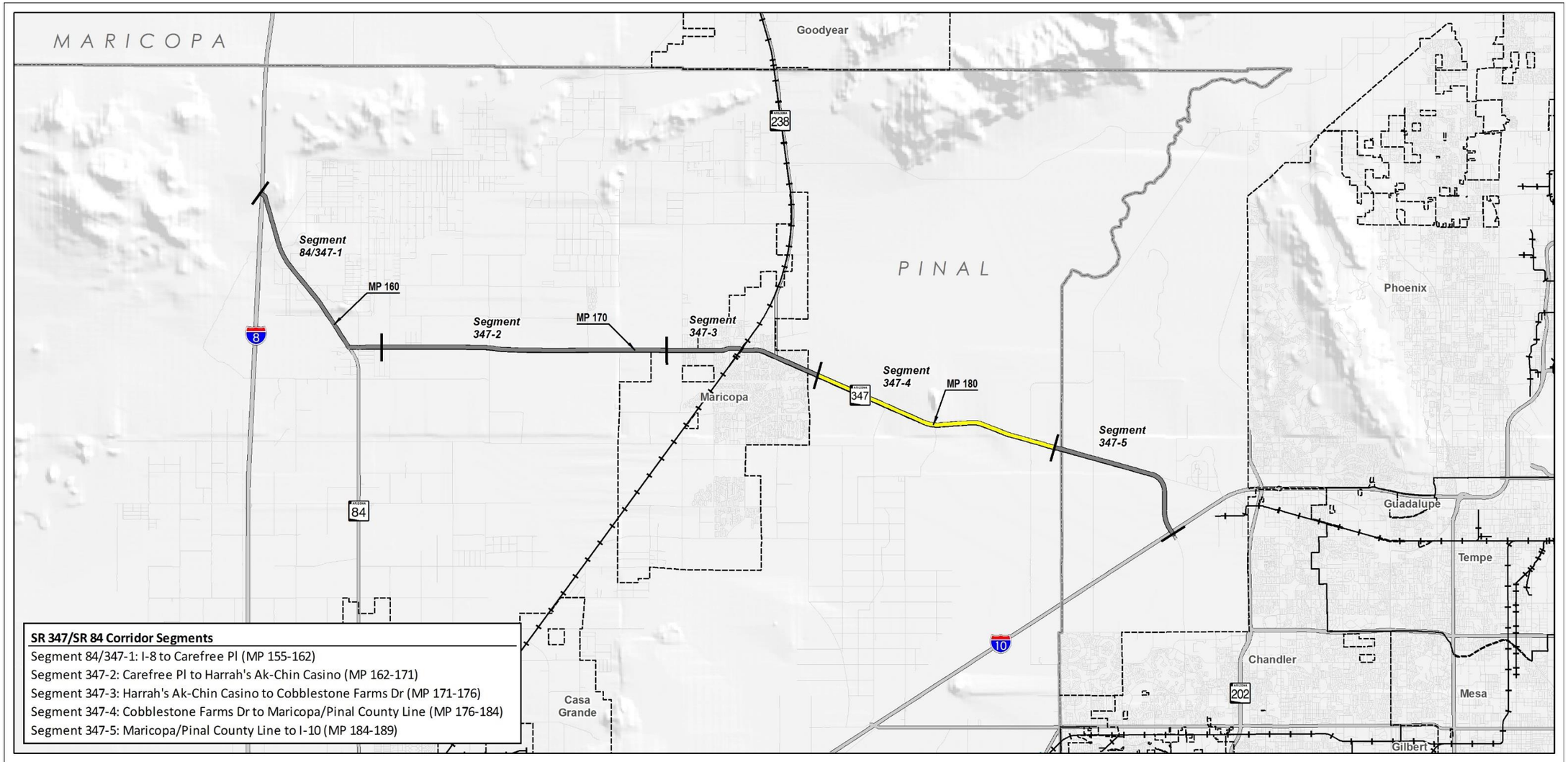
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Bridge Index and Hot Spots
2016 Data



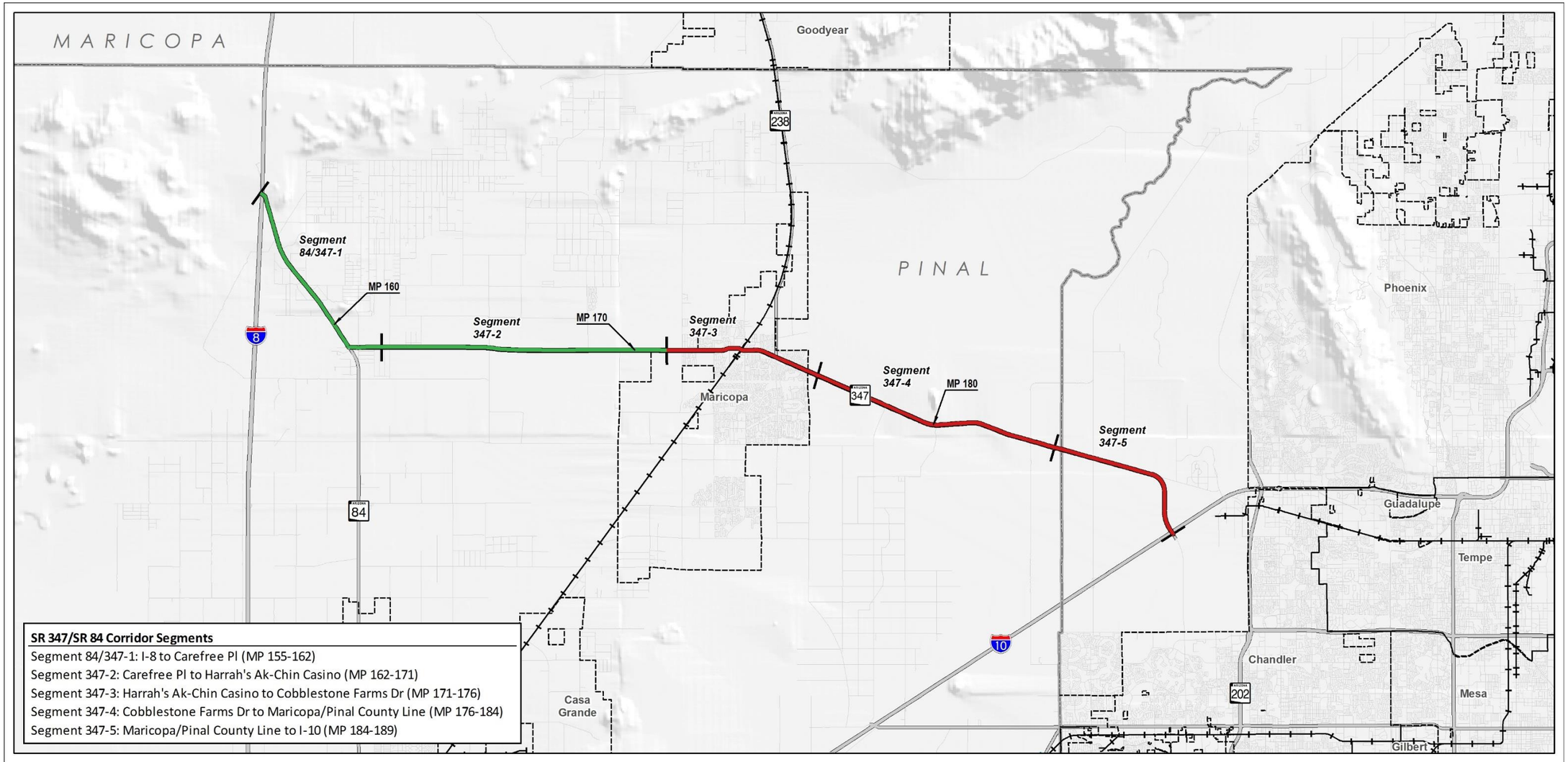
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Bridge Sufficiency
2016 Data



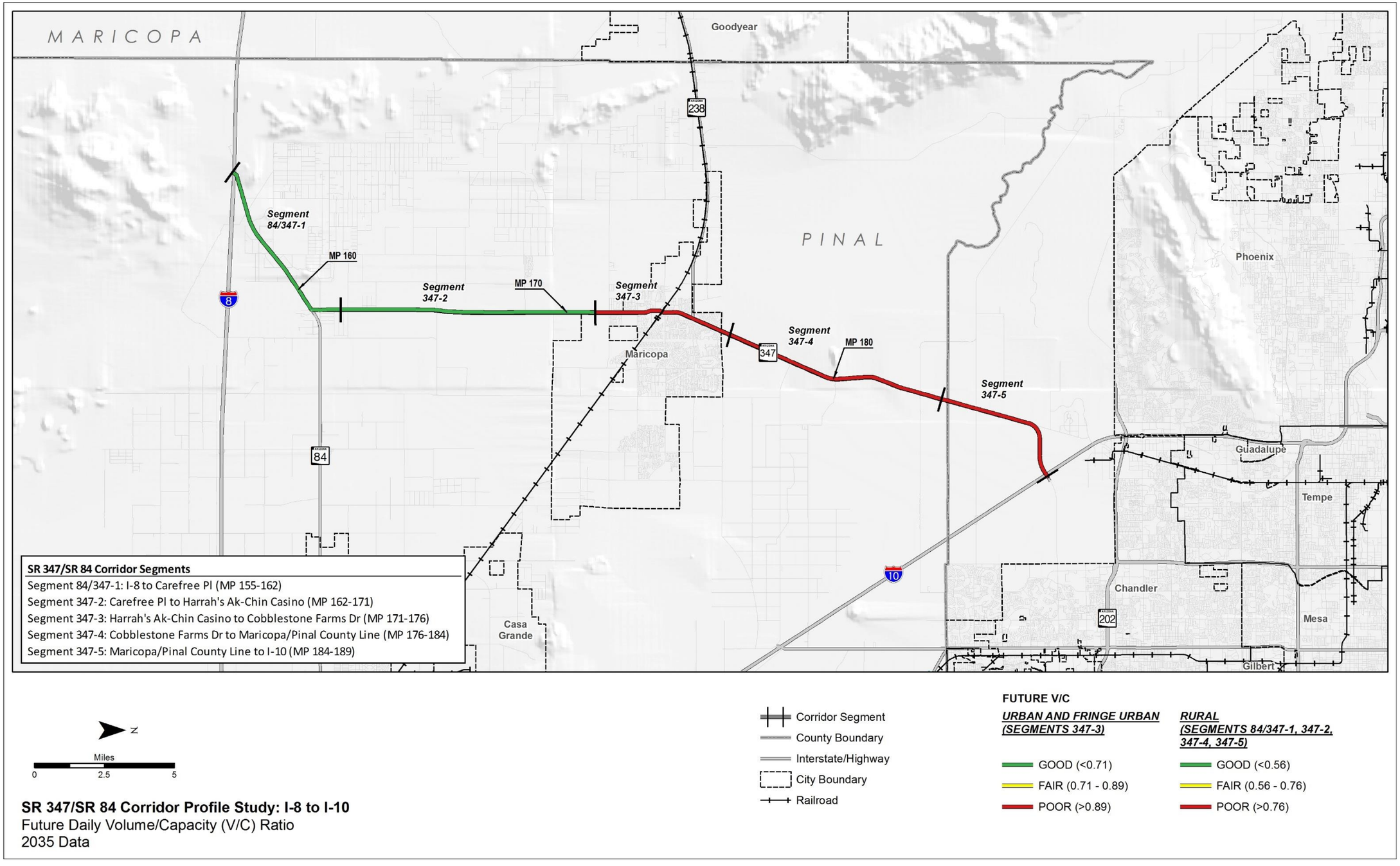
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Percentage of Deck Area on Functionally Obsolete Bridges
2016 Data



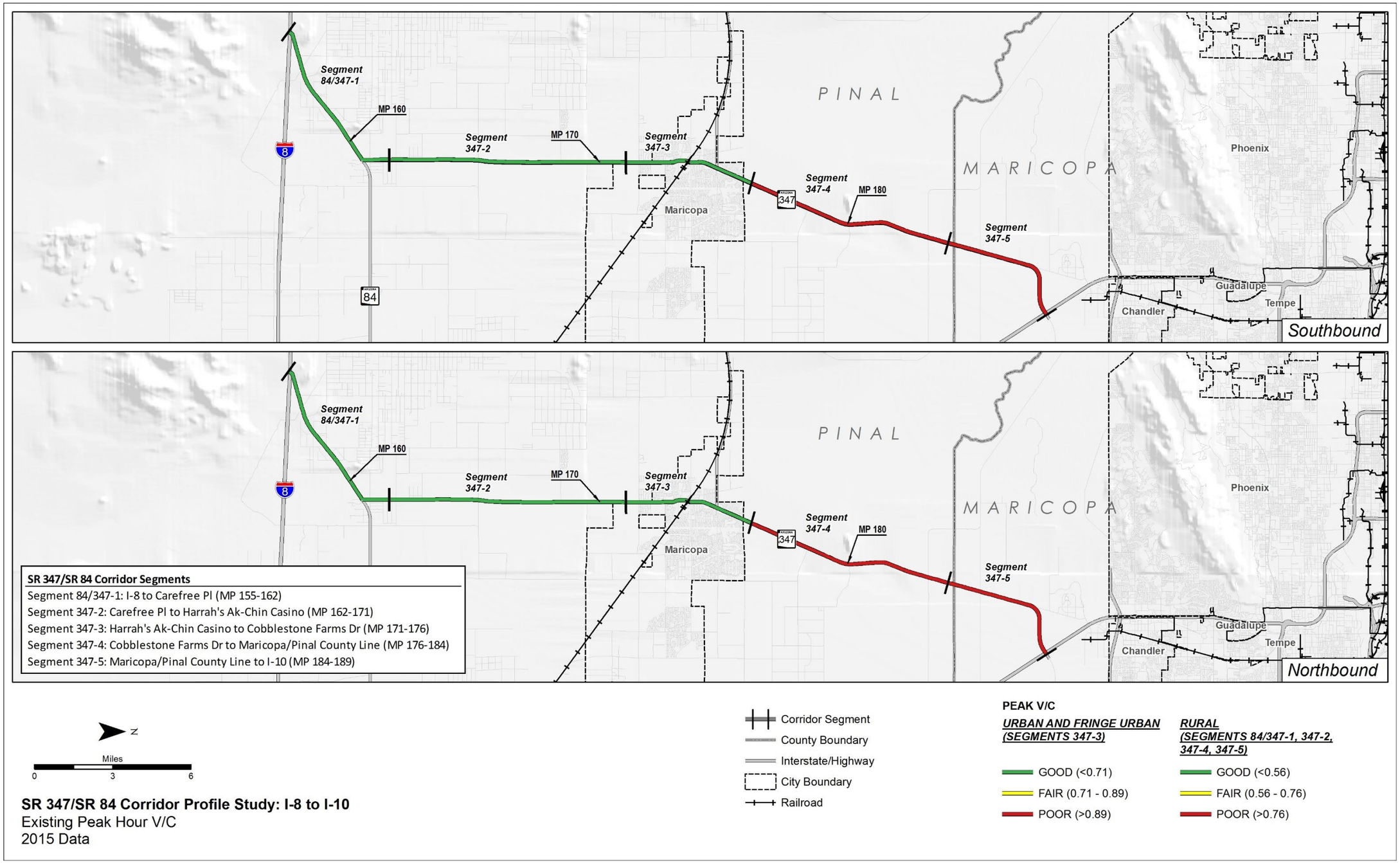
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Bridge Rating
2016 Data



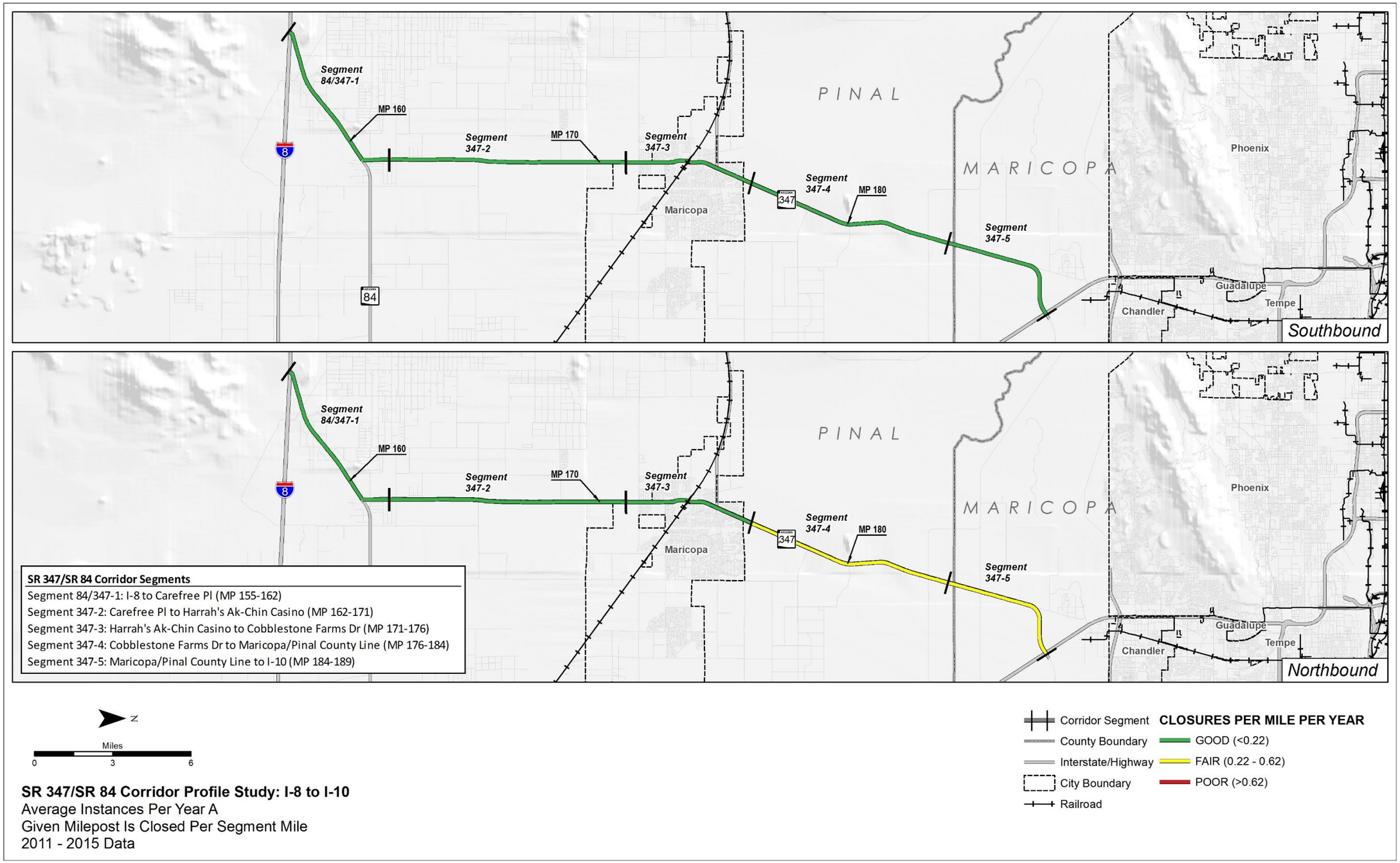
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Mobility Index
2015 and 2035 Data



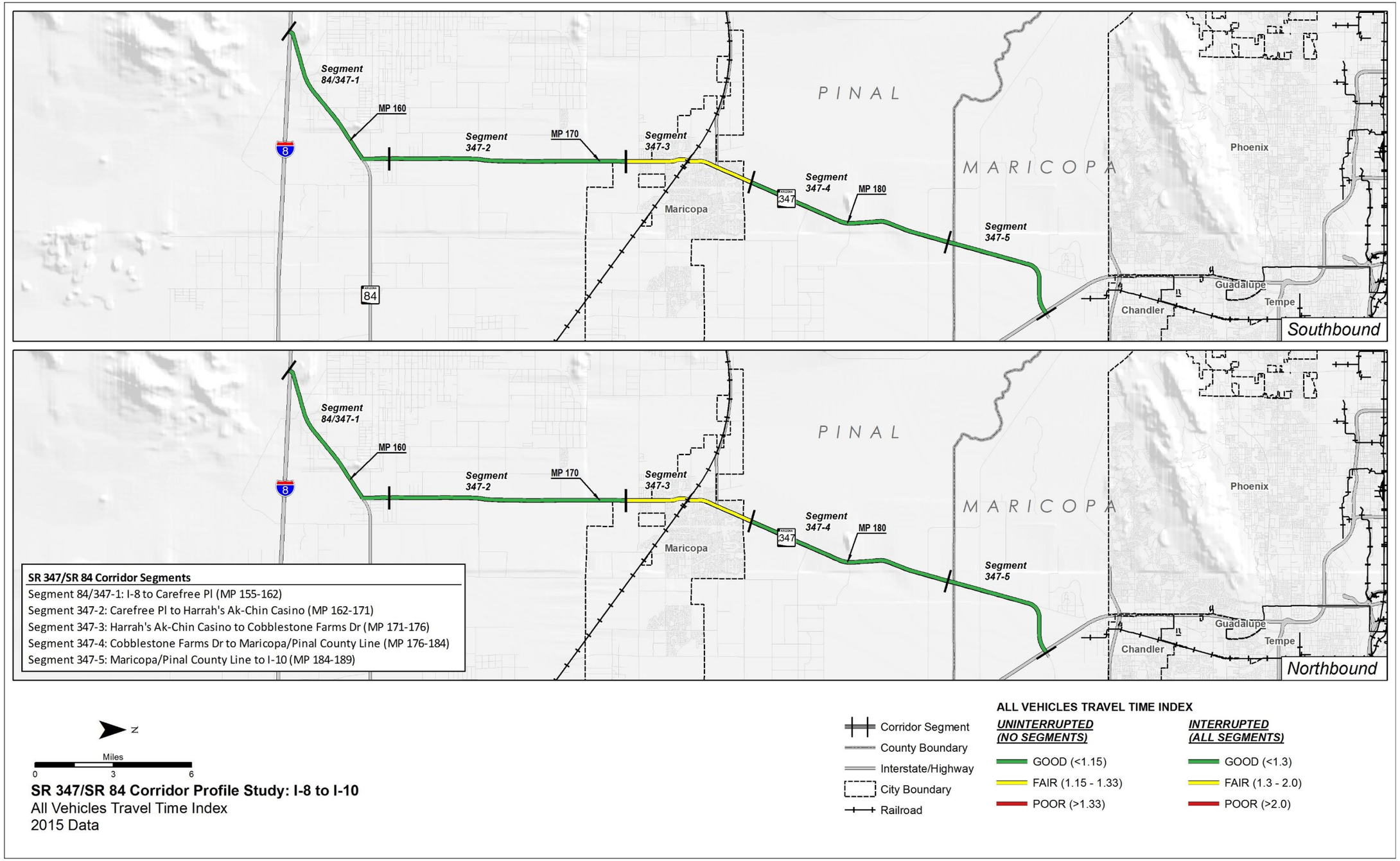
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Future Daily Volume/Capacity (V/C) Ratio
2035 Data



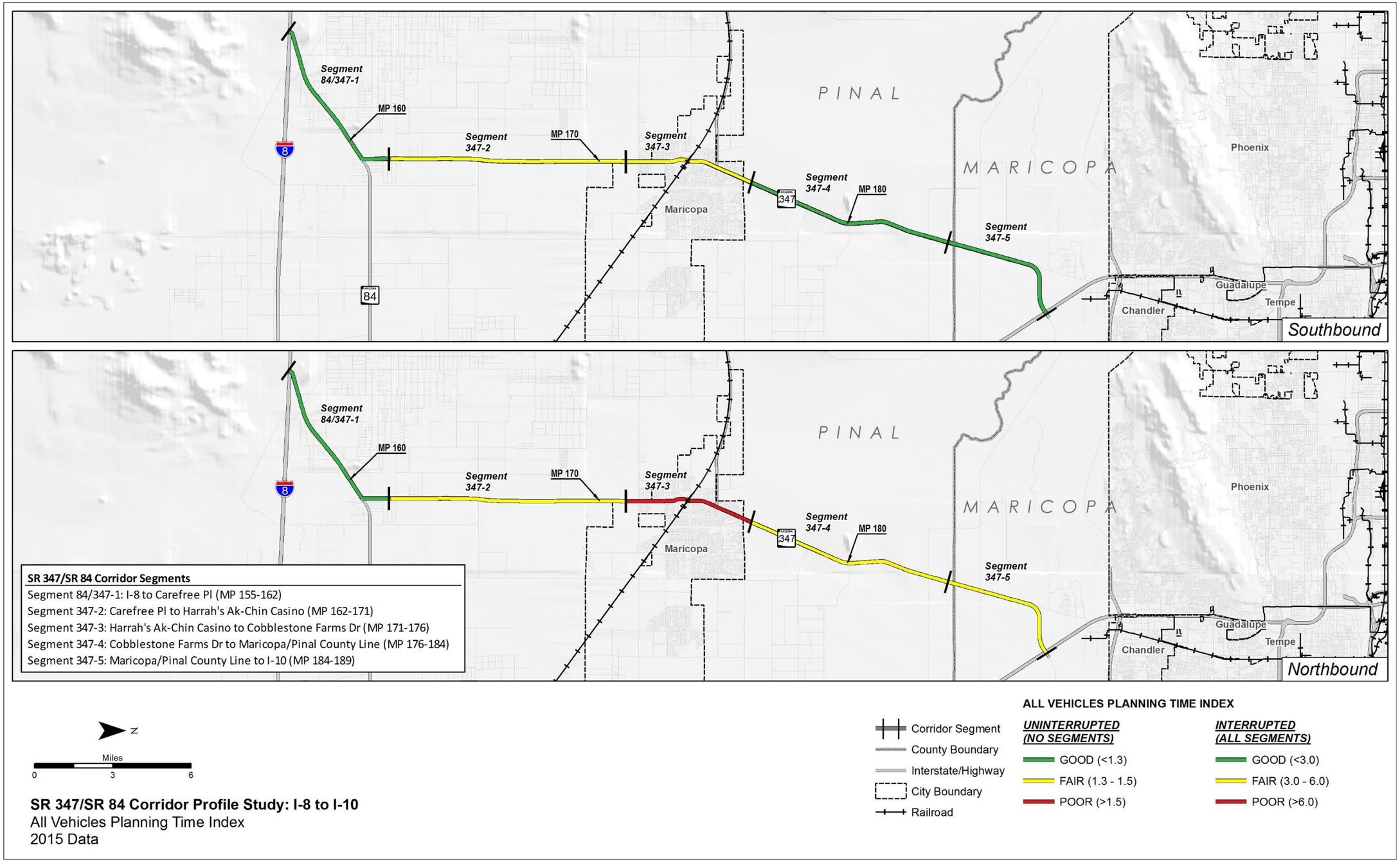
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Existing Peak Hour V/C
2015 Data



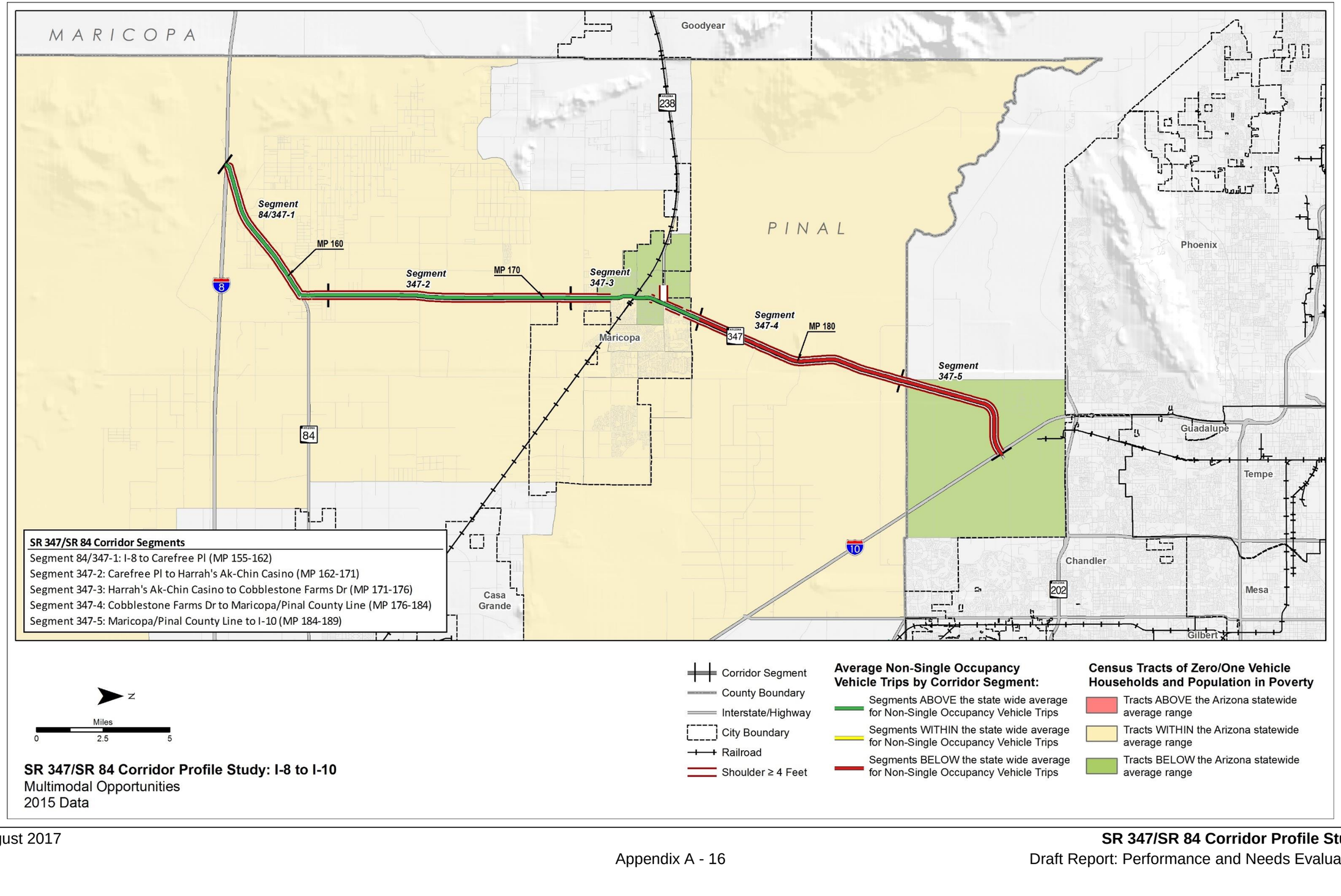
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Average Instances Per Year A
Given Milepost Is Closed Per Segment Mile
2011 - 2015 Data



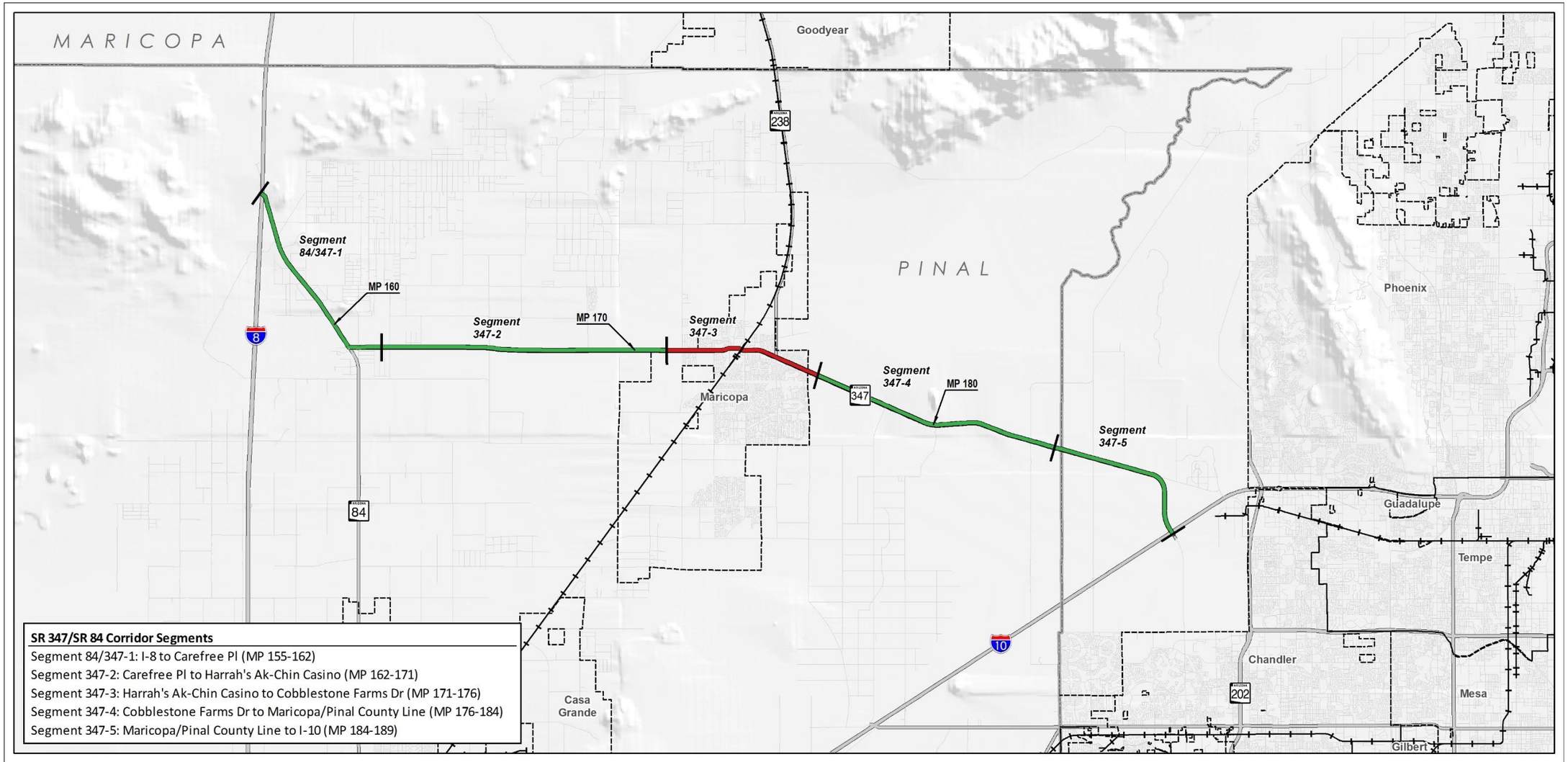
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
All Vehicles Travel Time Index
2015 Data



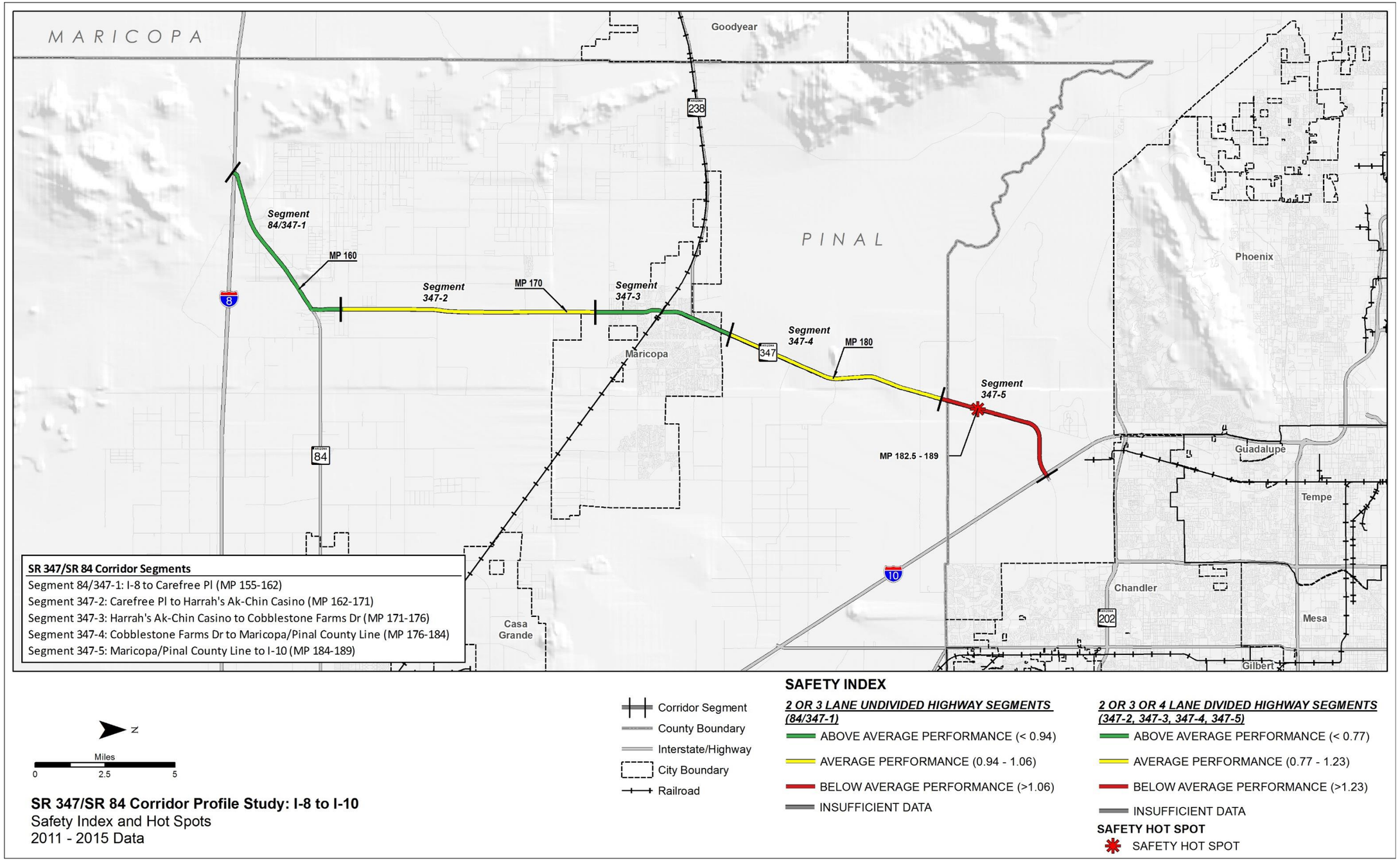
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
All Vehicles Planning Time Index
2015 Data



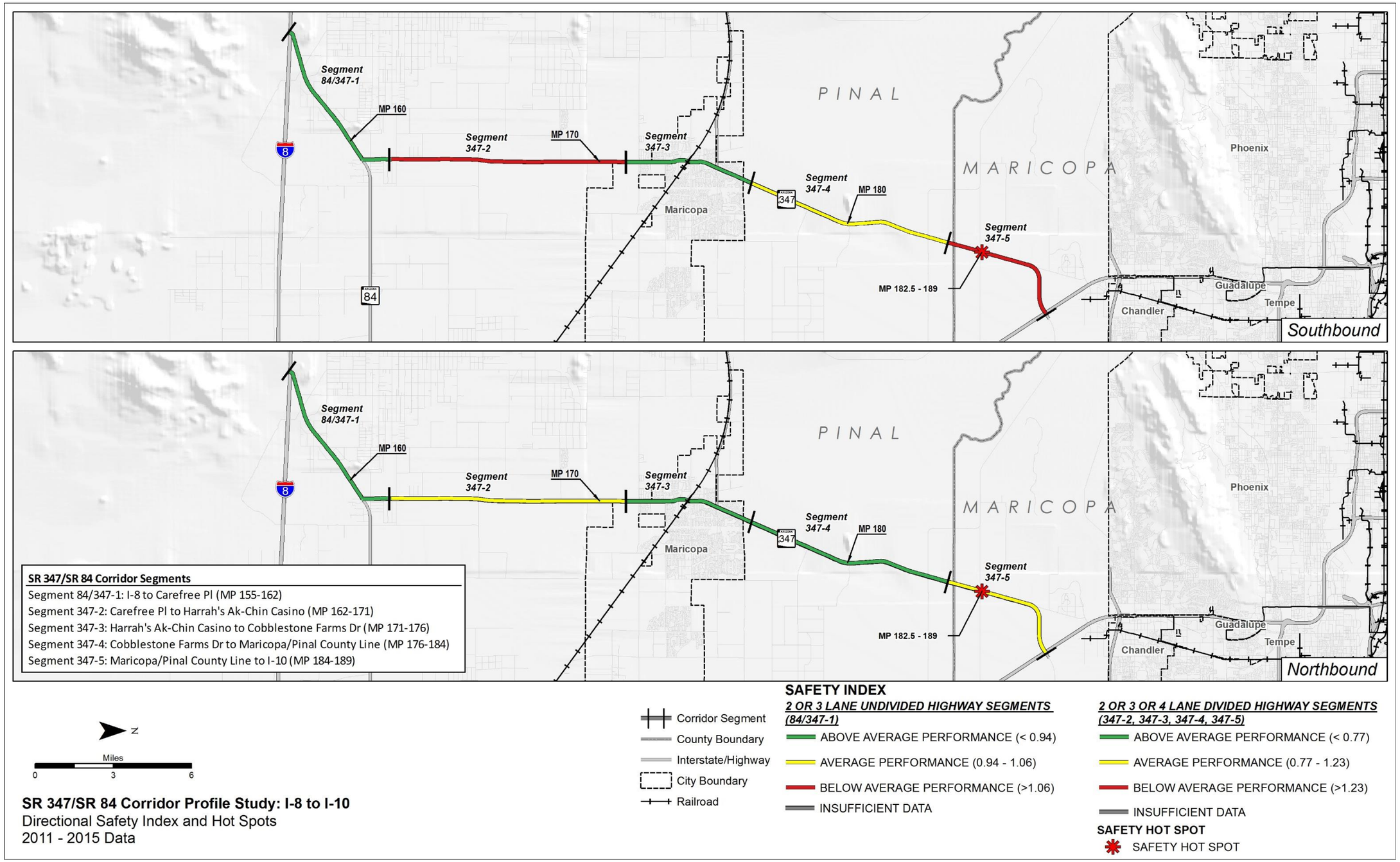
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Multimodal Opportunities
2015 Data



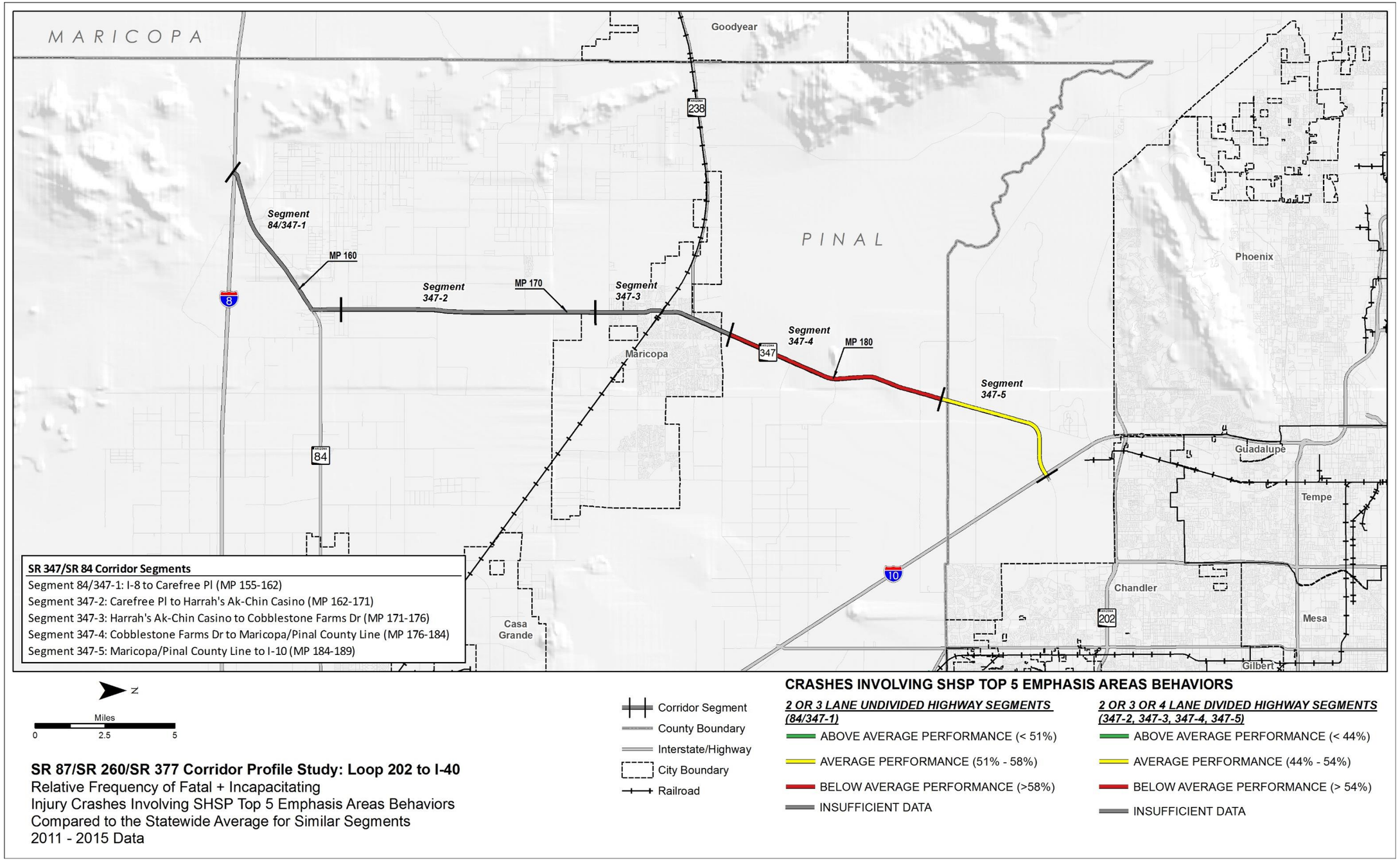
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Percentage of Bicycle Accommodation
2015 Data



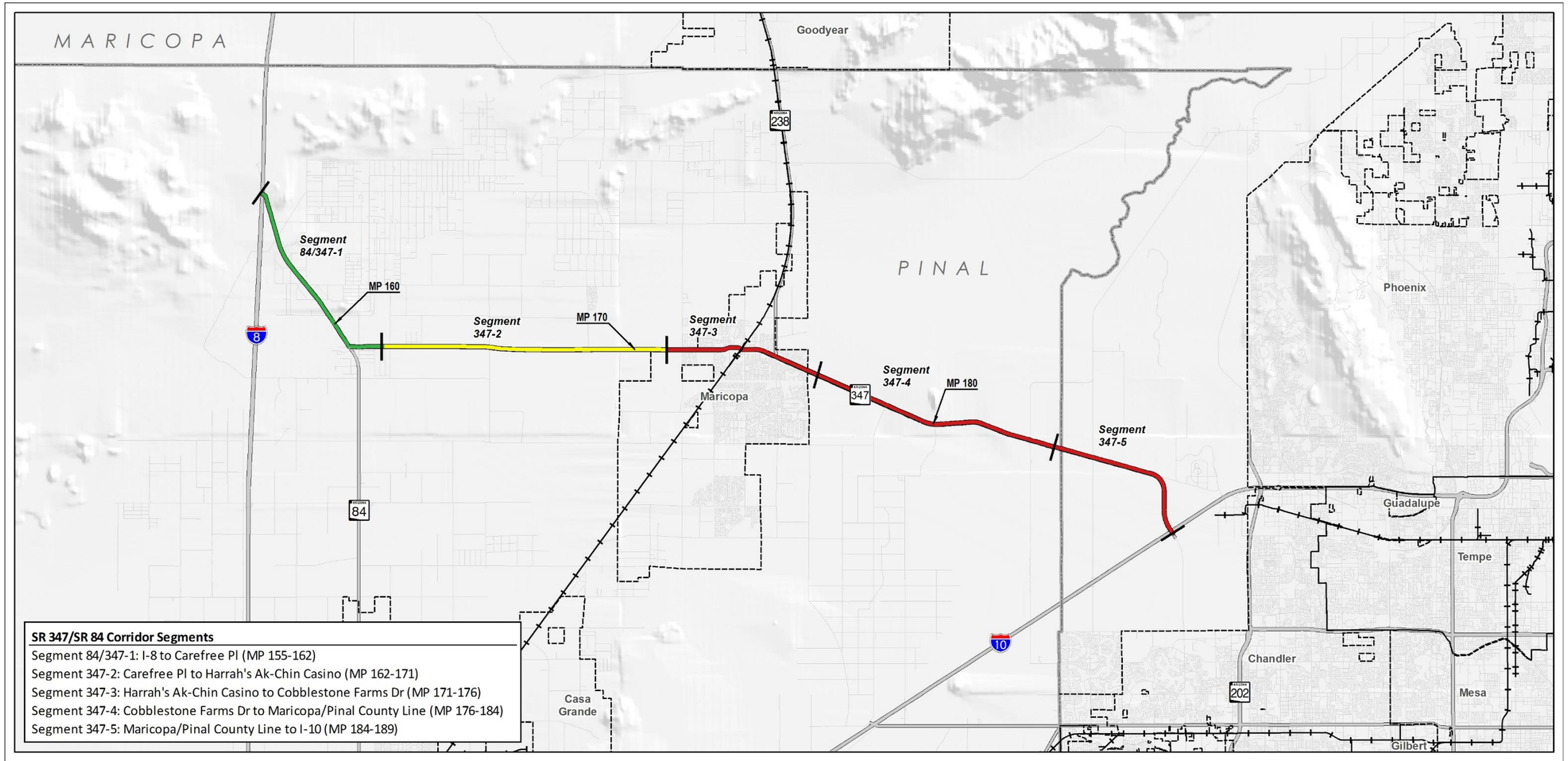
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Safety Index and Hot Spots
2011 - 2015 Data



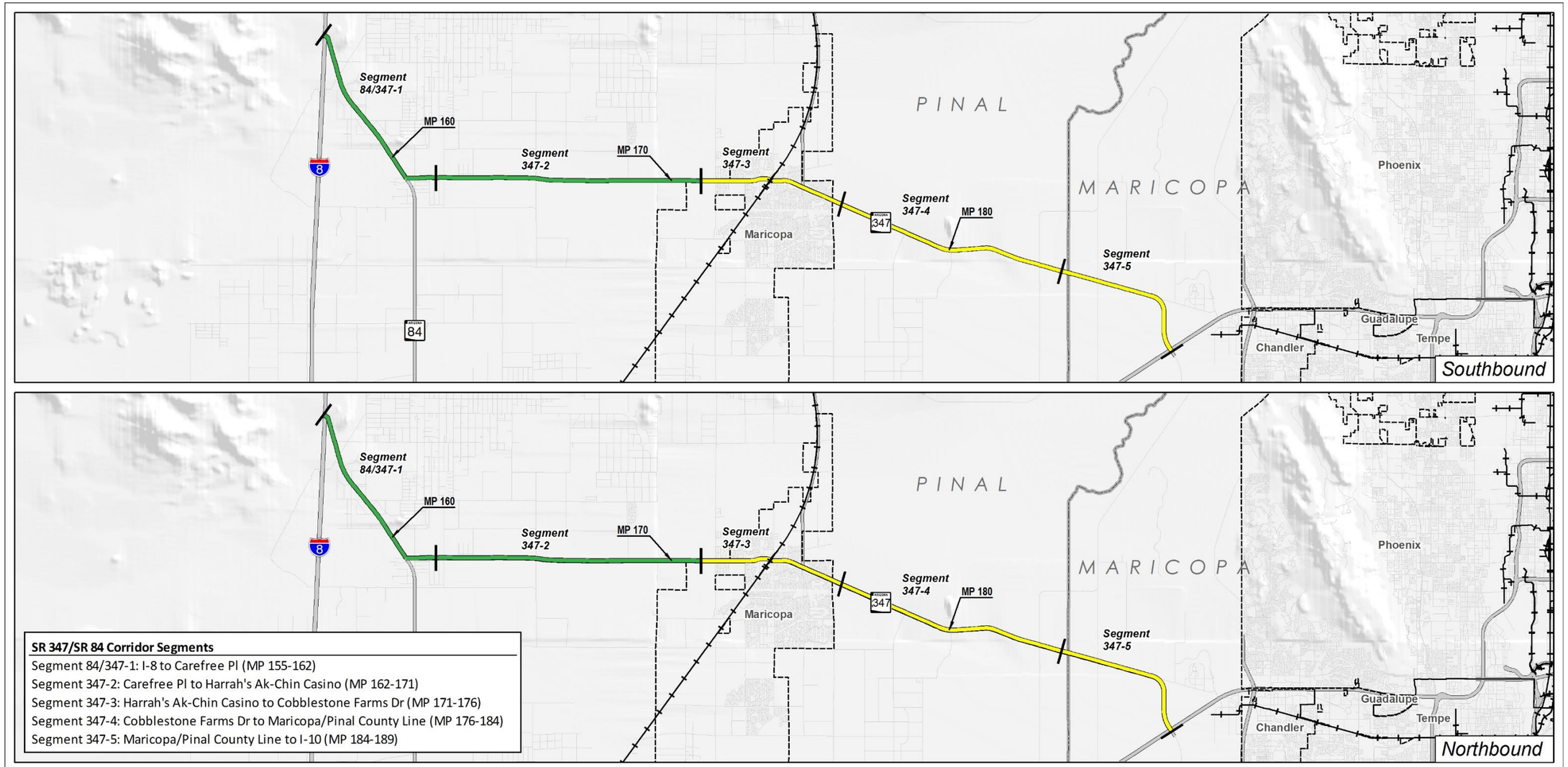
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Directional Safety Index and Hot Spots
2011 - 2015 Data



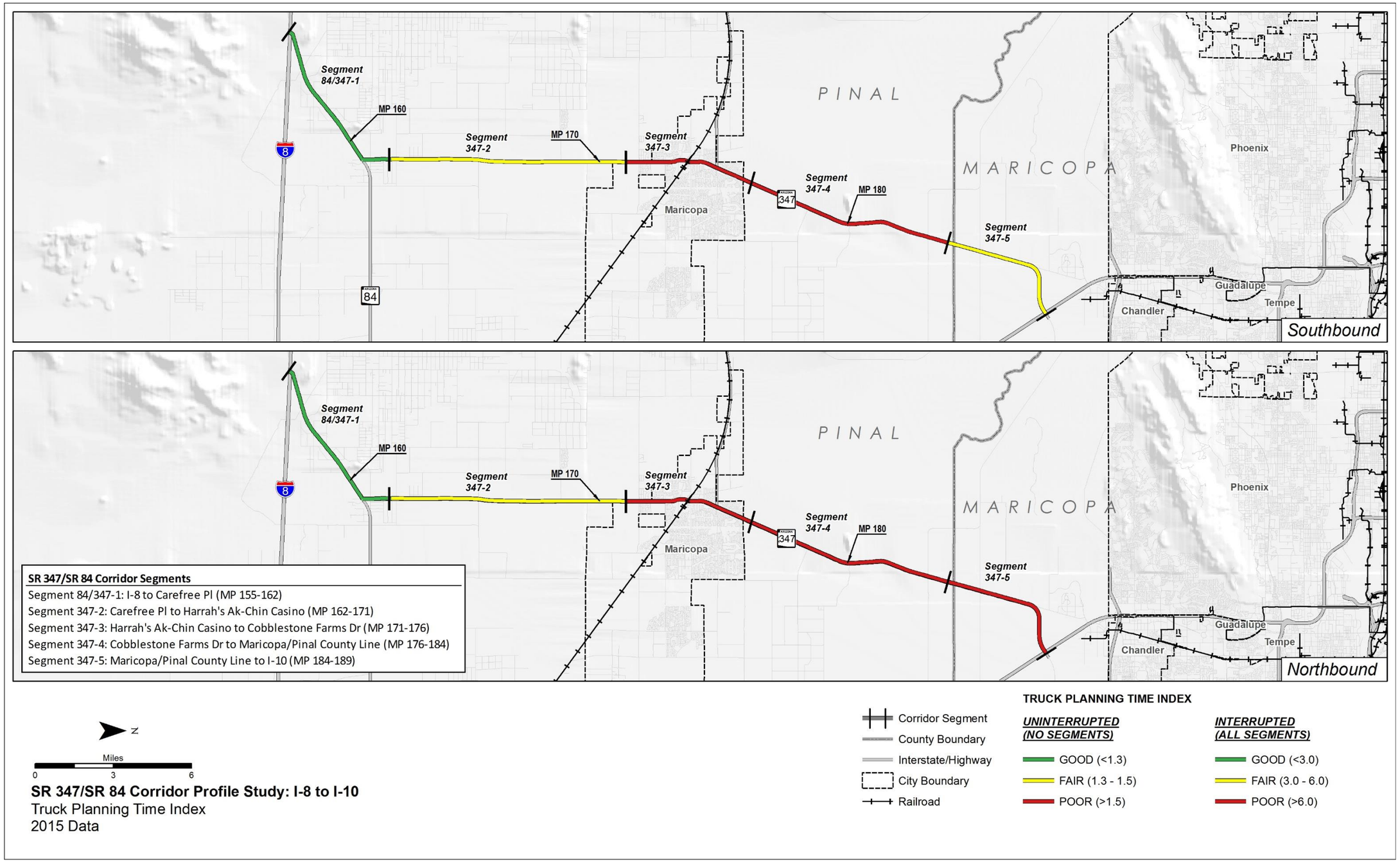
SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Relative Frequency of Fatal + Incapacitating
Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors
Compared to the Statewide Average for Similar Segments
2011 - 2015 Data

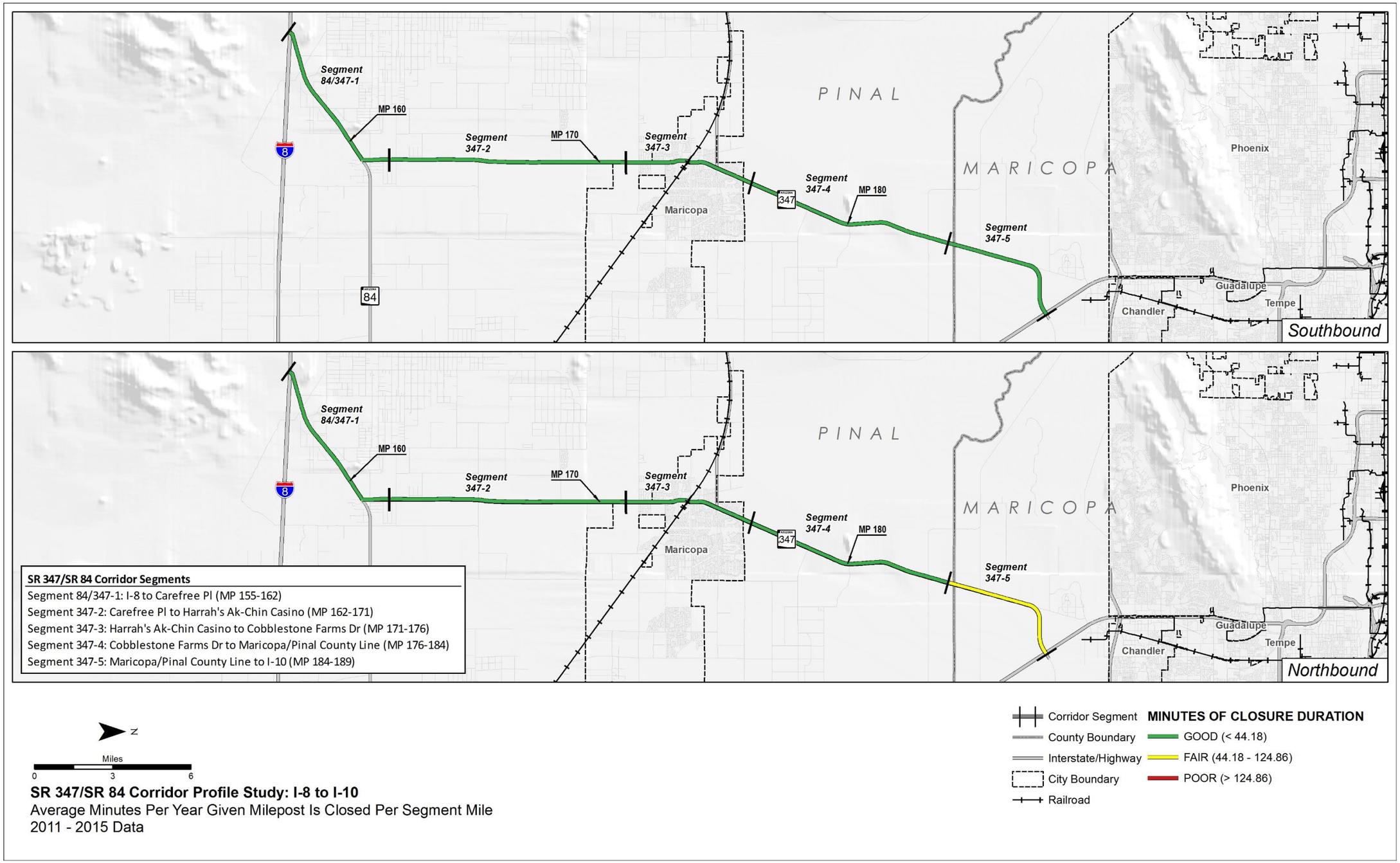


SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Freight Index and Hot Spots
2015 Data



SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Truck Travel Time Index
2015 Data


Segment 84/347-1
MP 160
Segment 347-2
MP 170
Segment 347-3
Segment 347-4
MP 180
Segment 347-5
PINAL
MARICOPA
Maricopa
Phoenix
Guadalupe
Tempe
Chandler
84
347
8
Southbound
Northbound
SR 347/SR 84 Corridor Segments
Segment 84/347-1: I-8 to Carefree Pl (MP 155-162)
Segment 347-2: Carefree Pl to Harrah's Ak-Chin Casino (MP 162-171)
Segment 347-3: Harrah's Ak-Chin Casino to Cobblestone Farms Dr (MP 171-176)
Segment 347-4: Cobblestone Farms Dr to Maricopa/Pinal County Line (MP 176-184)
Segment 347-5: Maricopa/Pinal County Line to I-10 (MP 184-189)
N
Miles
0
3
6
SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Truck Planning Time Index
2015 Data
TRUCK PLANNING TIME INDEX
Corridor Segment
County Boundary
Interstate/Highway
City Boundary
Railroad
UNINTERRUPTED (NO SEGMENTS)
GOOD (<1.3)
FAIR (1.3 - 1.5)
POOR (>1.5)
INTERRUPTED (ALL SEGMENTS)
GOOD (<3.0)
FAIR (3.0 - 6.0)
POOR (>6.0)

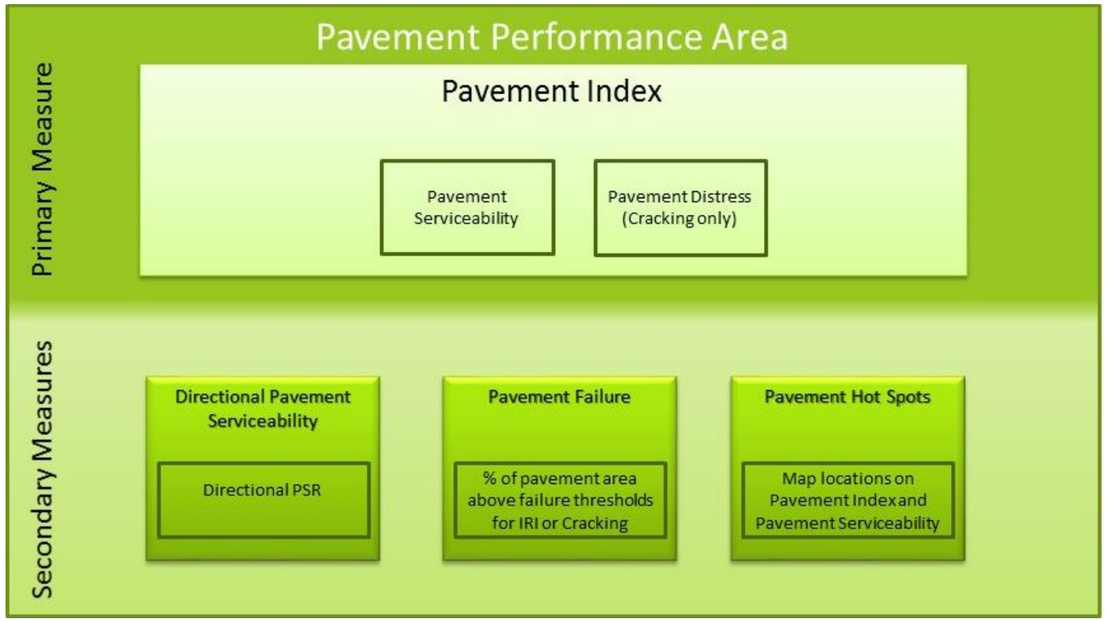


SR 347/SR 84 Corridor Profile Study: I-8 to I-10
Average Minutes Per Year Given Milepost Is Closed Per Segment Mile
2011 - 2015 Data

Appendix B: Performance Area Detailed Calculation Methodologies

Pavement Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Pavement performance area as shown in the following graphic:



This performance area is used to evaluate mainline pavement condition. Pavement condition data for ramps, frontage roads, crossroads, etc. was not included in the evaluation.

Primary Pavement Index

The Pavement Index is calculated based on the use of two pavement condition ratings from the ADOT Pavement Database. The two ratings are the International Roughness Index (IRI) and the Cracking rating. The calculation of the Pavement Index uses a combination of these two ratings.

The IRI is a measurement of the pavement roughness based on field-measured longitudinal roadway profiles. To facilitate the calculation of the index, the IRI rating was converted to a Pavement Serviceability Rating (PSR) using the following equation:

$$PSR = 5 * e^{-0.0038*IRI}$$

The Cracking Rating is a measurement of the amount of surface cracking based on a field-measured area of 1,000 square feet that serves as a sample for each mile. To facilitate the calculation of the index, the Cracking Rating was converted to a Pavement Distress Index (PDI) using the following equation:

$$PDI = 5 - (0.345 * C^{0.66})$$

Both the PSR and PDI use a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest performance. The performance thresholds for interstates and non-interstates shown in the tables below were used for the PSR and PDI.

Performance Level for Interstates	IRI (PSR)	Cracking (PDI)
Good	<75 (>3.75)	<7 (>3.75)
Fair	75 - 117 (3.20 - 3.75)	7 - 12 (3.22 - 3.75)
Poor	>117 (<3.20)	>12 (<3.22)

Performance Level for Non-Interstates	IRI (PSR)	Cracking (PDI)
Good	<94 (>3.5)	<9 (>3.5)
Fair	94 - 142 (2.9 - 3.5)	9 - 15 (2.9 - 3.5)
Poor	>142 (<2.9)	>15 (<2.9)

The PSR and PDI are calculated for each 1-mile section of roadway. If PSR or PDI falls into a poor rating (<3.2 for interstates, for example) for a 1-mile section, then the score for that 1-mile section is entirely (100%) based on the lower score (either PSR or PDI). If neither PSR or PDI fall into a poor rating for a 1-mile section, then the score for that 1-mile section is based on a combination of the lower rating (70% weight) and the higher rating (30% weight). The result is a score between 0 and 5 for each direction of travel of each mile of roadway based on a combination of both the PSR and the PDI.

The project corridor has been divided into segments. The Pavement Index for each segment is a weighted average of the directional ratings based on the number of travel lanes. Therefore, the condition of a section with more travel lanes will have a greater influence on the resulting segment Pavement Index than a section with fewer travel lanes.

Secondary Pavement Measures

Three secondary measures are evaluated:

- Directional Pavement Serviceability
- Pavement Failure
- Pavement Hot Spots

Directional Pavement Serviceability: Similar to the Pavement Index, the Directional Pavement Serviceability is calculated as a weighted average (based on number of lanes) for each segment. However, this rating only utilizes the PSR and is calculated separately for each direction of travel. The PSR uses a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest performance.

Pavement Failure: The percentage of pavement area rated above the failure thresholds for IRI or Cracking is calculated for each segment. In addition, the Standard score (z-score) is calculated for each segment.

The Standard score (z-score) is the number of standard deviations above or below the mean. Therefore, a Standard score between -0.5 and +0.5 is "average", less than -0.5 is lower (better) than average, and higher than +0.5 is above (worse) than average.

Pavement Hot Spots: The Pavement Index map identifies locations that have an IRI rating or Cracking rating that fall above the failure threshold as identified by ADOT Pavement Group. For interstates, an IRI rating above 105 or a Cracking rating above 15 will be used as the thresholds which are slightly different than the ratings shown previously. For non-interstates, an IRI rating above 142 or a Cracking rating above 15 will be used as the thresholds.

Scoring

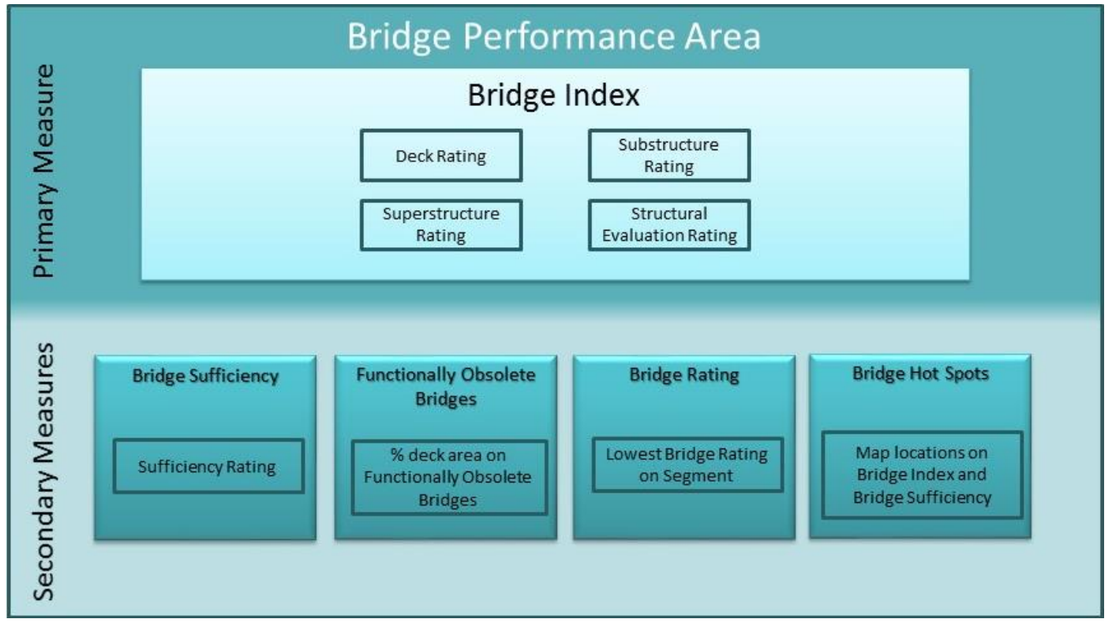
Performance Level	Pavement Index	
	Interstates	Non-Interstates
Good	>3.75	>3.5
Fair	3.2 - 3.75	2.9 - 3.5
Poor	<3.2	<2.9

Performance Level	Directional Pavement Serviceability	
	Interstates	Non-Interstates
Good	>3.75	>3.5
Fair	3.2 - 3.75	2.9 - 3.5
Poor	<3.2	<2.9

Performance Level	% Pavement Failure
Good	< 5%
Fair	5% – 20%
Poor	>20%

Bridge Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Bridge performance area as shown in the following graphic:



This performance area is used to evaluate mainline bridges. Bridges on ramps (that do not cross the mainline), frontage roads, etc. should not be included in the evaluation. Basically, any bridge that carries mainline traffic or carries traffic over the mainline should be included and bridges that do not carry mainline traffic, run parallel to the mainline (frontage roads), or do not cross the mainline should not be included.

Primary Bridge Index

The Bridge Index is calculated based on the use of four bridge condition ratings from the ADOT Bridge Database, also known as the Arizona Bridge Information and Storage System (ABISS). The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. The calculation of the Bridge Index uses the lowest of these four ratings.

Each of the four condition ratings use a 0 to 9 scale with 0 representing the lowest performance and 9 representing the highest performance.

The project corridor has been divided into segments and the bridges are grouped together according to the segment definitions. In order to report the Bridge Index for each corridor segment, the Bridge Index for each segment is a weighted average based on the deck area for each bridge. Therefore, the condition of a larger bridge will have a greater influence on the resulting segment Bridge Index than a smaller bridge.

Secondary Bridge Measures

Four secondary measures will be evaluated:

- Bridge Sufficiency
- Functionally Obsolete Bridges
- Bridge Rating
- Bridge Hot Spots

Bridge Sufficiency: Similar to the Bridge Index, the Bridge Sufficiency rating is calculated as a weighted average (based on deck area) for each segment. The Bridge Sufficiency rating is a scale of 0 to 100 with 0 representing the lowest performance and 100 representing the highest performance. A rating of 80 or above represents “good” performance, a rating between 50 and 80 represents “fair” performance, and a rating below 50 represents “poor” performance.

Functionally Obsolete Bridges: The percentage of total deck area in a segment that is on functionally obsolete bridges is calculated for each segment. The deck area for each bridge within each segment that has been identified as functionally obsolete is totaled and divided by the total deck area for the segment to calculate the percentage of deck area on functionally obsolete bridges for each segment.

The thresholds for this performance measure are determined based on the Standard score (z-score). The Standard score (z-score) is the number of standard deviations above or below the mean. Therefore, a Standard score between -0.5 and +0.5 is “average”, less than -0.5 is lower (better) than average, and higher than +0.5 is above (worse) average.

Bridge Rating: The Bridge Rating simply identifies the lowest bridge rating on each segment. This performance measure is not an average and therefore is not weighted based on the deck area. The Bridge Index identifies the lowest rating for each bridge, as described above. Each of the four condition ratings use a 0 to 9 scale with 0 representing the lowest performance and 9 representing the highest performance.

Bridge Hot Spots: The Bridge Index map identifies individual bridge locations that are identified as hot spots. Hot spots are bridges that have a single rating of 4 in any of the four ratings, or multiple ratings of 5 in the deck, substructure or superstructure ratings.

Scoring:

Performance Level	Bridge Index
Good	>6.5
Fair	5.0-6.5
Poor	<5.0

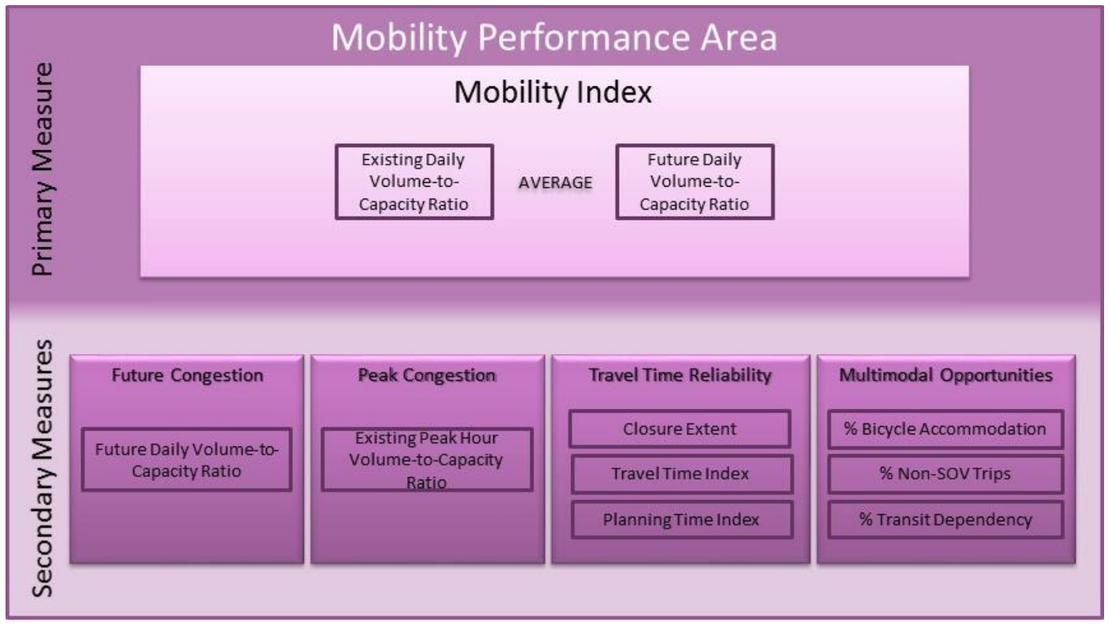
Performance Level	Sufficiency Rating
Good	>80
Fair	50-80
Poor	<50

Performance Level	Bridge Rating
Good	>6
Fair	5-6
Poor	<5

Performance Level	% Functionally Obsolete
Good	< 12%
Fair	12%-40%
Poor	>40%

Mobility Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Mobility performance area as shown in the following graphic:



Primary Mobility Index

The primary Mobility Index is an average of the existing daily volume-to-capacity (V/C) ratio and the future daily V/C ratio for each segment of the corridor.

Existing Daily V/C: The existing daily V/C ratio for each segment is calculated by dividing the 2014 Annual Average Daily Traffic (AADT) volume for each segment by the total Level of Service (LOS) E capacity volume for that segment

The capacity is calculated using the HERS Procedures for Estimating Highway Capacity[1]. The HERS procedure incorporates HCM 2010 methodologies. The methodology includes capacity estimation procedures for multiple facility types including freeways, rural two-lane highways, multilane highways, and signalized and non-signalized urban sections.

The segment capacity is defined as a function of the number of mainline lanes, shoulder width, interrupted or uninterrupted flow facilities, terrain type, percent of truck traffic, and the designated urban or rural environment.

The AADT for each segment is calculated by applying a weighted average across the length of the segment based on the individual 24-hour volumes and distances associated with each HPMS count station within each segment.

The following example equation is used to determine the weighted average of a segment with two HPMS count locations within the corridor

((HPMS 1 Distance x HPMS 1 Volume) + (HPMS 2 Distance x HPMS 2 Volume))/Total Segment Length

For specific details regarding the HERS methodology used, refer to the *Procedures for Estimating Highway Capacity, draft Technical Memorandum.*

Future Daily V/C: The future daily V/C ratio for each segment is calculated by dividing the 2035 AADT volume for each segment by the 2014 LOS E capacity. The capacity volume used in this calculation is the same as is utilized in the existing daily V/C equation.

The future AADT daily volumes are generated by applying an average annual compound growth rate (ACGR) to each 2014 AADT segment volume. The following equation is used to apply the average annual compound growth rate:

2035 AADT = 2014 AADT x ((1+ACGR)^(2035-2014))

The ACGR for each segment is defined by comparing the total volumes in the 2010 Arizona Travel Demand Model (AZTDM2) to the 2035 AZTDM2 traffic volumes at each existing HPMS count station location throughout the corridor. Each 2010 and 2035 segment volume is defined using the same weighted average equation described in the *Existing Daily V/*C section above and then summing the directional volumes for each location. The following equation is used to determine the ACGR for each segment:

ACGR = ((2035 Volume/2010 Volume)^(1/(2035-2010))))-1

Secondary Mobility Measures

Four secondary measures are evaluated:

- Future Congestion
- Peak Congestion
- Travel Time Reliability

[1] HERS Support – 2011, Task 6: Procedures for Estimating Highway Capacity, draft Technical Memorandum. Cambridge Systematics. Prepared for the Federal Highway Administration. March 2013.

  - Closure Extent
  - Directional Travel Time Index
  - Directional Planning Time Index
- Multimodal Opportunities
  - % Bicycle Accommodation
  - % Non-Single Occupancy Vehicle (SOV) Trips
  - % Transit Dependency

Future Congestion: The future daily V/C ratios for each segment in the corridor that are calculated and used in the Mobility Index as part of the overall average between Existing Daily V/C and Future Daily V/C are applied independently as a secondary measure. The methods to calculate the Future Daily V/C can be referenced in the Mobility Index section.

Peak Congestion: Peak Congestion has been defined as the peak hour V/C ratio in both directions of the corridor. The peak hour V/C ratio is calculated using the HERS method as described previously. The peak hour volume utilizes the directional AADT for each segment, which is calculated by applying a weighted average across the length of the segment based on the individual directional 24-hour volumes and distances associated with each HPMS count station within each segment. The segment capacity is defined based on the characteristics of each segment including number of lanes, terrain type, and environment, similar to the 24-hour volumes using the HERS method.

Travel Time Reliability: Travel time reliability is a secondary measure that includes three indicators. The three indicators are the number of times a piece of a corridor is closed for any specific reason, the directional Travel Time Index (TTI), and the directional Planning Time Index (PTI).

Closure Extent: The number of times a roadway is closed is documented through the HCRS dataset. Closure Extent is defined as the average number of times a particular milepost of the corridor is closed per year per mile in a specific direction of travel. The weighted average of each occurrence takes into account the distance over which a specific occurrence spans.

Thresholds that determine levels of good, fair, and poor are based on the average number of closures per mile per year within each of the identified statewide significant corridors by ADOT. The thresholds shown at the end of this section represent statewide averages across those corridors.

Directional Travel Time and Planning Time Index: In terms of overall mobility, the TTI is the relationship of the mean peak period travel time in a specific section of the corridor to the free-flow travel time in the same location. The PTI is the relationship of the 95th percentile highest travel time to the free-flow travel time (based on the posted speed limit) in a specific section of the corridor. The TTI and PTI can be converted into speed-based indices by recognizing that speed is equal to distance traveled divided by travel time. The inverse relationship between travel time and speed means that the 95th percentile highest travel time corresponds to the 5th percentile lowest speed.

Using HERE data provided by ADOT, four time periods for each data point were collected throughout the day (AM peak, mid-day, PM peak, and off-peak). Using the mean speeds and 5th percentile lowest mean speeds collected over 2014 for these time periods for each data location, four TTI and PTI calculations were made using the following formulas:

TTI = Posted Speed Limit/Mean Peak Hour Speed

PTI = Posted Speed Limit/5th Percentile Lowest Speed

The highest value of the four time periods calculation is defined as the TTI for that data point. The average TTI is calculated within each segment based on the number of data points collected. The value of the average TTI across each entry is used as the TTI for each respective segment within the corridor.

Multimodal Opportunities: Three multimodal opportunity indicators reflect the characteristics of the corridor that promote alternate modes to a single occupancy vehicle (SOV) for trips along the corridor. The three indicators include the percent bicycle accommodation, non-SOV trips, and transit dependency along the corridor.

Percent Bicycle Accommodation: For this secondary performance evaluation, outside shoulder widths are evaluated considering the roadway's context and conditions. This requires use of the roadway data that includes right shoulder widths, shoulder surface types, and speed limits, all of which are available in the following ADOT geographic information system (GIS) data sets:

- Right Shoulder Widths
- Left Shoulder Widths (for undivided roadways)
- Shoulder Surface Type (Both Left/Right)
- Speed Limit

Additionally, each segment's average AADT, estimated earlier in the Mobility performance area methodology, is used for the criteria to determine if the existing shoulder width meets the effective width.

The criteria for screening if a shoulder segment meets the recommended width criteria are as followed:

(1) If AADT <= 1500 OR Speed Limit <= 25 miles per hour (mph):
The segment's general purpose lane can be shared with bicyclists (no effective shoulder width required)

(2) If AADT > 1500 AND Speed Limit between (25 - 50 mph) AND Pavement Surface is Paved:
Effective shoulder width required is 4 feet or greater

(3) If AADT > 1500 AND Speed Limit >= 50 mph and Pavement Surface is Paved:
Effective shoulder width required is 6 feet or greater

The summation of the length of the shoulder sections that meet the defined effective width criteria, based on criteria above, is divided by the segment's total length to estimate the percent of the segment that accommodates bicycles as illustrated at the end of this section. If shoulder data is not available or appears erroneous, field measurements can substitute for the shoulder data.

Percent Non-SOV Trips: The percentage of non-SOV trips over distances less than 50 miles gives an indication of travel patterns along a section of the corridor that could benefit from additional multimodal options in the future.

Thresholds that determine levels of good, fair, and poor are based on the percent non-SOV trips within each of the identified statewide significant corridors by ADOT. The thresholds shown at the end of this section represent statewide averages across those corridors.

Percent Transit Dependency: 2008-2012 U.S. Census American Community Survey tract and state level geographic data and attributes from the tables B08201 (Number of Vehicles Available by Household Size) and B17001 (Population in Poverty within the Last 12 Months) were downloaded with margins of error included from the Census data retrieval application Data Ferret. Population ranges for each tract were determined by adding and subtracting the margin of error to each estimate in excel. The tract level attribute data was then joined to geographic tract data in GIS. Only tracts within a one mile buffer of each corridor are considered for this evaluation.

Tracts that have a statistically significantly larger number of either people in poverty or households with only one or no vehicles available than the state average are considered potentially transit dependent.

Example: The state average for zero or one vehicles households (HHs) is between 44.1% and 45.0%. Tracts which have the lower bound of their range above the upper bound of the state range have a greater percentage of zero/one vehicle HHs than the state average. Tracts that have their upper bound beneath the lower bound of the state range have a lesser percentage of zero/one vehicles HHs than the state average. All other tracts that have one of their bounds overlapping with the state average cannot be considered statistically significantly different because there is a chance the value is actually the same.

In addition to transit dependency, the following attributes are added to the Multimodal Opportunities map based on available data.

- Shoulder width throughout the corridor based on 'Shoulder Width' GIS dataset provided by ADOT
- Intercity bus routes
- Multiuse paths within the corridor right-of-way, if applicable

Scoring:

Volume-to-Capacity Ratios		
Urban and Fringe Urban		
Good - LOS A-C	V/C ≤ 0.71	*Note - ADOT Roadway Design Standards indicate Urban and Fringe Urban roadways should be designed to level of service C or better
Fair - LOS D	V/C > 0.71 & ≤ 0.89	
Poor - LOS E or less	V/C > 0.89	
Rural		
Good - LOS A-B	V/C ≤ 0.56	*Note - ADOT Roadway Design Standards indicate Rural roadways should be designed to level of service B or better
Fair - LOS C	V/C > 0.56 & ≤ 0.76	
Poor - LOS D or less	V/C > 0.76	

Performance Level	Closure Extent
Good	≤ 0.22
Fair	> 0.22 & ≤ 0.62
Poor	V/C > 0.62

Performance Level	TTI on Uninterrupted Flow Facilities
Good	< 1.15
Fair	≥ 1.15 & < 1.33
Poor	≥ 1.33

Performance Level	TTI on Interrupted Flow Facilities
Good	< 1.30
Fair	≥ 1.30 & < 1.2.00
Poor	≥ 2.00

Performance Level	PTI on Uninterrupted Flow Facilities
Good	< 1.30
Fair	≥ 1.30 & < 1.50
Poor	≥ 1.50

Performance Level	PTI Interrupted Flow Facilities
Good	< 3.00
Fair	≥ 3.00 & < 6.00
Poor	≥ 6.00

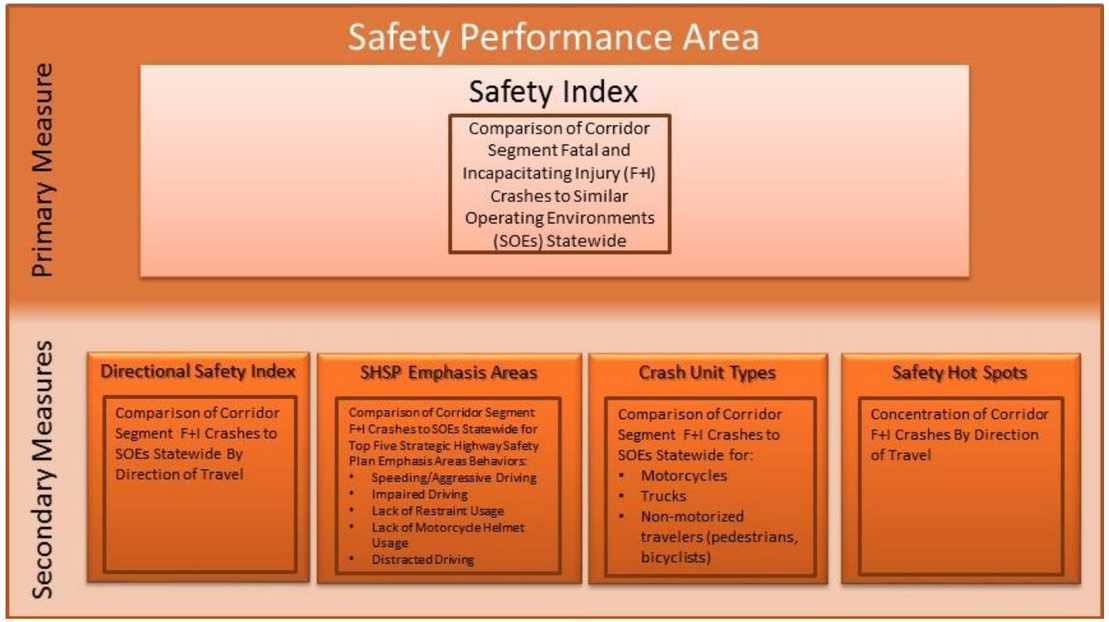
Performance Level	Percent Bicycle Accommodation
Good	≥ 90%
Fair	> 60% & ≤ 90%
Poor	< 60%

Performance Level	Percent Non-SOV Trips
Good	≥ 17%
Fair	> 11% & ≤ 17%
Poor	< 11%

Performance Level	Percent Transit Dependency
Good	Tracts with both zero and one vehicle household population in poverty percentages below the statewide average
Fair	Tracts with either zero and one vehicle household or population in poverty percentages below the statewide average
Poor	Tracts with both zero and one vehicle household and population in poverty percentages above the statewide average

Safety Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Safety performance area as shown in the following graphic:



Primary Safety Index

The Safety Index is a safety performance measure based on the bi-directional (i.e., both directions combined) frequency and rate of fatal and incapacitating injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2010 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 14.5 times the estimated cost of incapacitating injury crashes ($5.8 million compared to $400,000).

The Combined Safety Score (CSS) is an interim measure that combines fatal and incapacitating injury crashes into a single value. The CSS is calculated using the following generalized formula:

*CSS = 14.5 * (Normalized Fatal Crash Rate + Frequency) + (Normalized Incapacitating Injury Crash Rate + Frequency)*

Because crashes vary depending on the operating environment of a particular roadway, statewide CSS values were developed for similar operating environments defined by functional classification, urban vs. rural setting, number of travel lanes, and traffic volumes. To determine the Safety Index of a particular segment, the segment CSS is compared to the average statewide CSS for the similar statewide operating environment.

The Safety Index is calculated using the following formula:

Safety Index = Segment CSS / Statewide Similar Operating Environment CSS

The average annual Safety Index for a segment is compared to the statewide similar operating environment annual average, with one standard deviation from the statewide average forming the scale break points.

The more a particular segment's Safety Index value is below the statewide similar operating environment average, the better the safety performance is for that particular segment as a lower value represents fewer crashes.

Scoring:

The scale for rating the Safety Index depends on the operating environments selected, as shown in the table below.

Similar Operating Environment	Safety Index (Overall & Directional)	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	0.94	1.06
2 or 3 or 4 Lane Divided Highway	0.77	1.23
4 or 5 Lane Undivided Highway	0.80	1.20
6 Lane Highway	0.56	1.44
Rural 4 Lane Freeway with Daily Volume < 25,000	0.73	1.27
Rural 4 Lane Freeway with Daily Volume > 25,000	0.68	1.32
Urban 4 Lane Freeway	0.79	1.21
Urban or Rural 6 Lane Freeway	0.82	1.18
Urban > 6 Lane Freeway	0.80	1.20

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Some corridor segments may have a very low number of total fatal and incapacitating injury crashes. Low crash frequencies (i.e., a small sample size) can translate into performance ratings that can be unstable. In some cases, a change in crash frequency of one crash (one additional crash or one less crash) could result in a change in segment performance of two levels. To avoid reliance on performance ratings where small changes in crash frequency result in large changes in performance, the following two criteria were developed to identify segments with "insufficient data" for assessing performance for the Safety Index. Both of these criteria must be met for a segment to have "insufficient data" to reliably rate the Safety Index performance:

- If the crash sample size (total fatal plus incapacitating injury crashes) for a given segment is less than five crashes over the five-year analysis period; AND

- If a change in one crash results in a change in segment performance by two levels (i.e., a change from below average to above average performance or a change from above average to below average frequency), the segment has "insufficient data" and Safety Index performance ratings are unreliable.

Secondary Safety Measures

The Safety performance area has four secondary measures related to fatal and incapacitating injury crashes:

- Directional Safety Index
- Strategic Highway Safety Plan (SHSP) Behavior Emphasis Areas
- Crash Unit Types
- Safety Hot Spots

Directional Safety Index: The Direction Safety Index shares the same calculation procedure and thresholds as the Safety Index. However, the measure is based on the directional frequency and rate of fatal and incapacitating injury crashes.

Similar to the Safety Index, the segment CSS is compared to the average statewide CSS for the similar statewide operating environment. The Directional Safety Index follows the lead of the Safety Index in terms of "insufficient data" status. If the Safety Index meets both criteria for "insufficient data", the Directional Safety Index should also be changed to "insufficient data". If the Safety Index does not meet both criteria for "insufficient data", the Directional Safety Index would also not change to say "insufficient data"

SHSP Behavior Emphasis Areas: ADOT's 2014 SHSP identifies several emphasis areas for reducing fatal and incapacitating injury crashes. The top five SHSP emphasis areas relate to the following driver behaviors:

- Speeding and aggressive driving
- Impaired driving
- Lack of restraint usage
- Lack of motorcycle helmet usage
- Distracted driving

To develop a performance measure that reflects these five emphasis areas, the percentage of total fatal and incapacitating injury crashes that involves at least one of the emphasis area driver behaviors on a particular segment is compared to the statewide average percentage of crashes involving at least one of the emphasis area driver behaviors on roads with similar operating environments in a process similar to how the Safety Index is developed.

To increase the crash sample size for this performance measure, the five behavior emphasis areas are combined to identify fatal and incapacitating injury crashes that exhibit one or more of the behavior emphasis areas.

The SHSP behavior emphasis areas performance is calculated using the following formula:

% Crashes Involving SHSP Behavior Emphasis Areas = Segment Crashes Involving SHSP Behavior Emphasis Areas / Total Segment Crashes

The percentage of total crashes involving SHSP behavior emphasis areas for a segment is compared to the statewide percentages on roads with similar operating environments. One standard deviation from the statewide average percentage forms the scale break points.

When assessing the performance of the SHSP behavior emphasis areas, the more the frequency of crashes involving SHSP behavior emphasis areas is below the statewide average implies better levels of segment performance. Thus, lower values are better, similar to the Safety Index.

Scoring:

The scale for rating the SHSP behavior emphasis areas performance depends on the crash history on similar statewide operating environments, as shown in the table below:

Similar Operating Environment	Crashes in SHSP Top 5 Emphasis Areas	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	51.2%	57.5%
2 or 3 or 4 Lane Divided Highway	44.4%	54.4%
4 or 5 Lane Undivided Highway	42.4%	51.1%
6 Lane Highway	35.3%	46.5%
Rural 4 Lane Freeway with Daily Volume < 25,000	42.8%	52.9%
Rural 4 Lane Freeway with Daily Volume > 25,000	40.8%	57.1%
Urban 4 Lane Freeway	49.1%	59.4%
Urban or Rural 6 Lane Freeway	33.5%	57.2%
Urban > 6 Lane Freeway	42.6%	54.8%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

The SHSP behavior emphasis areas secondary safety performance measure for the Safety performance area includes proportions of specific types of crashes within the total fatal and incapacitating injury crash frequencies. This more detailed categorization of fatal and incapacitating injury crashes can result in low crash frequencies (i.e., a small sample size) that translate into performance ratings that can be unstable. In some cases, a change in crash frequency of one crash (one additional crash or one less crash) could result in a change in segment performance of two levels. To avoid reliance on performance ratings where small changes in crash frequency result in large changes in performance, the following criteria were developed to identify segments with "insufficient data" for assessing performance for the SHSP behavior emphasis areas secondary

safety performance measure. If any of these criteria are met for a segment, that segment has "insufficient data" to reliably rate the SHSP behavior emphasis areas performance:

- If the crash sample size (total fatal plus incapacitating injury crashes) for a given segment is less than five crashes over the five-year analysis period, the segment has "insufficient data" and performance ratings are unreliable. OR
- If a change in one crash results in a change in segment performance by two levels (i.e., a change from below average to above average performance or a change from above average to below average frequency), the segment has "insufficient data" and performance ratings are unreliable. OR
- If the corridor average segment crash frequency for the SHSP behavior emphasis areas performance measure is less than two crashes over the five-year analysis period, the entire SHSP behavior emphasis areas performance measure has "insufficient data" and performance ratings are unreliable.

Crash Unit Type Emphasis Areas: ADOT's SHSP also identifies emphasis areas that relate to the following "unit-involved" crashes:

- Heavy vehicle (trucks)-involved crashes
- Motorcycle-involved crashes
- Non-motorized traveler (pedestrians and bicyclists)-involved crashes

To develop a performance measure that reflects the aforementioned crash unit type emphasis areas, the percentage of total fatal and incapacitating injury crashes that involves a given crash unit type emphasis area on a particular segment is compared to the statewide average percentage of crashes involving that same crash unit type emphasis area on roads with similar operating environments in a process similar to how the Safety Index is developed.

The SHSP crash unit type emphasis areas performance is calculated using the following formula:

% Crashes Involving Crash Unit Type = Segment Crashes Involving Crash Unit Type / Total Segment Crashes

The percentage of total crashes involving crash unit types for a segment is compared to the statewide percentages on roads with similar operating environments. One standard deviation from the statewide average percentage forms the scale break points.

When assessing the performance of the crash unit types, the more the frequency of crashes involving crash unit types is below the statewide average implies better levels of segment performance. Thus, lower values are better, similar to the Safety Index. The scale for rating the unit-involved crash performance depends on the crash history on similar statewide operating environments, as shown in the following tables.

Scoring:

Similar Operating Environment	Crashes Involving Trucks	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	5.2%	7.1%
2 or 3 or 4 Lane Divided Highway	3.5%	7.3%
4 or 5 Lane Undivided Highway	6.1%	9.6%
6 Lane Highway	0.3%	8.7%
Rural 4 Lane Freeway with Daily Volume < 25,000	13.2%	17.0%
Rural 4 Lane Freeway with Daily Volume > 25,000	7.2%	12.9%
Urban 4 Lane Freeway	6.8%	10.9%
Urban or Rural 6 Lane Freeway	6.2%	11.0%
Urban > 6 Lane Freeway	2.5%	6.0%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Similar Operating Environment	Crashes Involving Motorcycles	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	18.5%	26.5%
2 or 3 or 4 Lane Divided Highway	16.3%	26.3%
4 or 5 Lane Undivided Highway	6.4%	9.4%
6 Lane Highway	0.0%	20.0%
Rural 4 Lane Freeway with Daily Volume < 25,000	5.0%	8.5%
Rural 4 Lane Freeway with Daily Volume > 25,000	7.7%	17.1%
Urban 4 Lane Freeway	9.3%	11.5%
Urban or Rural 6 Lane Freeway	6.7%	12.9%
Urban > 6 Lane Freeway	12.6%	20.5%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

Similar Operating Environment	Crashes Involving Non-Motorized Travelers	
	Lower Limit of Average*	Upper Limit of Average*
2 or 3 Lane Undivided Highway	2.2%	4.2%
2 or 3 or 4 Lane Divided Highway	2.4%	4.5%
4 or 5 Lane Undivided Highway	4.7%	7.9%
6 Lane Highway	8.4%	17.4%
Rural 4 Lane Freeway with Daily Volume < 25,000	1.7%	2.5%
Rural 4 Lane Freeway with Daily Volume > 25,000	0.0%	0.0%
Urban 4 Lane Freeway	4.8%	10.3%
Urban or Rural 6 Lane Freeway	0.9%	6.7%
Urban > 6 Lane Freeway	0.5%	1.5%

** Lower/upper limit of Average calculated as one standard deviation below/above the Mean*

The crash unit types have the same "insufficient data" criteria as the SHSP behavior emphasis areas.

Safety Hot Spots: A hot spot analysis was conducted that identified abnormally high concentrations of fatal and incapacitating injury crashes along the study corridor by direction of travel. The identification of crash concentrations involves a GIS-based function known as "kernel density analysis". This measure is mapped for graphical display purposes with the Directional Safety Index but is not included in the Safety performance area rating calculations.

Freight Performance Area Calculation Methodologies

This section summarizes the approach for developing the primary and secondary performance measures in the Freight performance area as shown in the following graphic:

Primary Freight Index

The Freight Index is a reliability performance measure based on the planning time index for truck travel. The industry standard definition for the Truck Planning Time Index (TPTI) is the ratio of total travel time needed for 95% on-time arrival to free-flow travel time. The TPTI reflects the extra buffer time needed for on-time delivery while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as crashes, inclement weather, and construction activities.

The TPTI can be converted into a speed-based index by recognizing that speed is equal to distance traveled divided by travel time. The inverse relationship between travel time and speed means that the 95th percentile highest travel time corresponds to the 5th percentile lowest speed. The speed-based TPTI is calculated using the following formula:

TPTI = Free-Flow Truck Speed / Observed 5th Percentile Lowest Truck Speed

Observed 5th percentile lowest truck speeds are available in the 2014 American Digital Cartography, Inc. HERE (formerly NAVTEQ) database to which ADOT has access. The free-flow truck speed is assumed to be 65 miles per hour or the posted speed, whichever is less. This upper limit of 65 mph accounts for governors that trucks often have that restrict truck speeds to no more than 65 mph, even when the speed limit may be higher.

For each corridor segment, the TPTI is calculated for each direction of travel and then averaged to create a bi-directional TPTI. When assessing performance using TPTI, the higher the TPTI value is above 1.0, the more buffer time is needed to ensure on-time delivery.

The Freight Index is calculated using the following formula to invert the overall TPTI:

Freight Index = 1 / Bi-directional TPTI

Inversion of the TPTI allows the Freight Index to have a scale where the higher the value, the better the performance, which is similar to the directionality of the scales of most of the other primary measures. This Freight Index scale is based on inverted versions of TPTI scales created previously by ADOT. The scale for rating the Freight Index differs between uninterrupted and interrupted flow facilities.

Secondary Freight Measures

The Freight performance area includes five secondary measures that provide an in-depth evaluation of the different characteristics of freight performance:

- Recurring Delay (Directional TTTI)
- Non-Recurring Delay (Directional TPTI)
- Closure Duration
- Bridge Vertical Clearance
- Bridge Vertical Clearance Hot Spots

Recurring Delay (Directional TTTI): The performance measure for recurring delay is the Directional Truck Travel Time Index (TTTI). The industry standard definition for TTTI is the ratio of average peak period travel time to free-flow travel time. The TTTI reflects the extra time spent in traffic during peak times due to recurring delay. Recurring delay refers to expected or normal delay due to roadway capacity constraints or traffic control devices.

Similar to the TPTI, the TTTI can be converted into a speed-based index by recognizing that speed is equal to distance traveled divided by travel time. The speed-based TTTI can be calculated using the following formula:

TTTI = Free-Flow Truck Speed / Observed Average Peak Period Truck Speed

Observed average peak period truck speeds are available in the 2014 American Digital Cartography, Inc. HERE (formerly NAVTEQ) database to which ADOT has access. The free-flow truck speed is assumed to be 65 mph or the posted speed, whichever is less.

For each corridor segment, the TTTI is calculated for each direction of travel. With the TTTI, the higher the TTTI value is above 1.0, the more time is spent in traffic during peak times. TTTI values are generally lower than TPTI values. The Directional TTTI scale is based on TTTI scales created previously by ADOT.

Non-Recurring Delay (Directional TPTI): The performance measure for non-recurring delay is the Directional TPTI. Directional TPTI is calculated as described previously as an interim step in the development of the Freight Index.

For each corridor segment, the TPTI is calculated for each direction of travel. With the TPTI, the higher the TPTI value is above 1.0, the more buffer time is needed to ensure on-time delivery.

Closure Duration: This performance measure related to road closures is average roadway closure (i.e., full lane closure) duration time in minutes. There are three main components to full closures that affect reliability – frequency, duration, and extent. In the freight industry, closure duration is the most important component because trucks want to minimize travel time and delay.

Data on the frequency, duration, and extent of full roadway closures on the ADOT State Highway System is available for 2010-2014 in the HCRS database that is managed and updated by ADOT.

The average closure duration in a segment – in terms of the average time a milepost is closed per mile per year on a given segment – is calculated using the following formula:

*Closure Duration = Sum of Segment (Closure Clearance Time * Closure Extent) / Segment Length*

The segment closure duration time in minutes can then be compared to statewide averages for closure duration in minutes, with one-half standard deviation from the average forming the scale break points. The scale for rating closure duration in minutes is found at the end of this section.

Bridge Vertical Clearance: This performance measure uses the vertical clearance information from the ADOT Bridge Database to identify locations with low vertical clearance. The minimum vertical clearance for all underpass structures (i.e., structures under which mainline traffic passes) is determined for each segment.

Bridge Vertical Clearance Hot Spots: This performance measure related to truck restrictions is the locations, or hot spots, where bridge vertical clearance issues restrict truck travel. Sixteen feet three inches (16.25') is the minimum standard vertical clearance value for state highway bridges over travel lanes.

Locations with lower vertical clearance values than the minimum standard are categorized by the ADOT Intermodal Transportation Department Engineering Permits Section as either locations where ramps exist that allow the restriction to be avoided or locations where ramps do not exist and the restriction cannot be avoided. The locations with vertical clearances below the minimum standard that cannot be ramped around are considered hot spots. This measure is mapped for graphical display purposes with the bridge vertical clearance map but is not included in the Freight performance area rating calculations.

Scoring:

Performance Level	Freight Index	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	> 0.77	> 0.33
Fair	0.67 – 0.77	0.17 – 0.33
Poor	< 0.67	< 0.17

Performance Level	TTTI	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	< 1.15	< 1.30
Fair	1.15 – 1.33	1.30 – 2.00
Poor	> 1.33	> 2.00

Performance Level	TPTI	
	Uninterrupted Flow Facilities	Interrupted Flow Facilities
Good	< 1.30	< 3.00
Fair	1.30 – 1.50	3.00 – 6.00
Poor	> 1.50	> 6.00

Performance Level	Closure Duration (minutes)
Good	< 44.18
Fair	44.18 – 124.86
Poor	> 124.86

Performance Level	Bridge Vertical Clearance
Good	> 16.5'
Fair	16.0' – 16.5'
Poor	< 16.0'

Appendix C: Performance Area Data

Pavement Performance Area Data

				Direction 1 (North/Eastbound)			Direction 2 (South/Westbound)			Direction 1 (North/Eastbound)		Direction 2 (South/Westbound)		Composite		Pavement Index	% Pavement Failure	
				# of Lanes	IRI	Cracking	# of Lanes	IRI	Cracking	PSR	PDI	PSR	PDI	Dir 1 (N/E)	Dir 2 (S/W)		Dir 1 (N/E)	Dir 2 (S/W)
Segment 1		***Interstate?***	**No**															
Milepost	155	to 156		1	43.11	0.10	1	43.11	0.10	4.24	-	4.24	-	4.24	4.24		0	0
Milepost	156	to 157		1	43.11	0.10	1	43.11	0.10	4.24	-	4.24	-	4.24	4.24		0	0
Milepost	157	to 158		1	44.38	0.10	1	44.38	0.10	4.22	-	4.22	-	4.22	4.22		0	0
Milepost	158	to 159		1	40.43	0.10	1	40.43	0.10	4.29	-	4.29	-	4.29	4.29		0	0
Milepost	159	to 160		1	40.12	0.10	1	40.12	0.10	4.29	-	4.29	-	4.29	4.29		0	0
Milepost	160	to 161		1	47.50	0.10	1	47.50	0.10	4.17	-	4.17	-	4.17	4.17		0	0
Milepost	161	to 162		2.0	84.36	7.00	2.0	58.38	6.00	3.63	3.8	4.01	3.9	3.67	3.91		0	0
		Total		8			8											0
		Weighted Average								4.09	0.94	4.18	0.97	4.10	4.16			
		Factor								1.00		1.00						
		Indicator Score								**4.09**		**4.18**						**0.0%**
		Pavement Index														**4.13**		
Segment 2		***Interstate?***	**No**															
Milepost	162	to 163		2	65.12	25.00	2	49.80	6.00	3.90	2.1	4.14	3.9	2.11	3.95		2	0
Milepost	163	to 164		2	58.68	30.00	2	52.81	3.00	4.00	1.7	4.09	4.3	1.74	4.15		2	0
Milepost	164	to 165		2	63.31	8.00	2	52.19	4.00	3.93	3.6	4.10	4.1	3.73	4.11		0	0
Milepost	165	to 166		2	53.45	5.00	2	46.63	7.00	4.08	4.0	4.19	3.8	4.03	3.88		0	0
Milepost	166	to 167		2	59.51	8.00	2	43.14	6.00	3.99	3.6	4.24	3.9	3.74	3.99		0	0
Milepost	167	to 168		2	71.56	6.00	2	41.90	7.00	3.81	3.9	4.26	3.8	3.83	3.91		0	0
Milepost	168	to 169		2	48.32	4.00	2	44.10	8.00	4.16	4.1	4.23	3.6	4.15	3.82		0	0
Milepost	169	to 170		2	39.81	0.00	2	36.22	0.00	4.30	5.0	4.36	5.0	4.51	4.55		0	0
Milepost	170	to 171		2	30.95	0.00	2	30.67	0.00	4.45	5.0	4.45	5.0	4.61	4.61		0	0
		Total		18			18											4
		Weighted Average								4.07	3.68	4.23	4.15	3.61	4.11			
		Factor								1.00		1.00						
		Indicator Score								**4.07**		**4.23**						**11.1%**
		Pavement Index														**3.86**		
Segment 3		***Interstate?***	**No**															
Milepost	171	to 172		2	33.01	0.00	2	34.11	0.00	4.41	5.0	4.39	5.0	4.59	4.57		0	0
Milepost	172	to 173		2.0	119.03	0.00	3.0	70.68	0.00	3.18	5.0	3.82	5.0	3.73	4.18		0	0
Milepost	173	to 174		2	160.88	0.00	2.0	160.88	0.00	2.71	5.0	2.71	5.0	2.71	2.71		2	2
Milepost	174	to 175		3.0	149.17	5.00	3	126.41	0.00	2.84	4.0	3.09	5.0	2.84	3.66		3	0
Milepost	175	to 176		2	123.96	15.00	3.0	65.02	5.00	3.12	2.9	3.91	4.0	2.99	3.93		0	0
		Total		11			13											7

			Weighted Average						3.21	4.35	3.59	4.77	3.32	3.84			
			Factor						1.00		1.00						
			Indicator Score						**3.21**		**3.59**						**29.2%**
			Pavement Index												**3.60**		
Segment 4		***Interstate?***	**No**														
Milepost	176	to 177	2	88.03	8.00	2	55.84	4.00	3.58	3.6	4.04	4.1	3.60	4.07		0	0
Milepost	177	to 178	2	69.34	3.00	2	57.18	5.00	3.84	4.3	4.02	4.0	3.98	4.01		0	0
Milepost	178	to 179	2	85.92	4.00	2	61.04	3.00	3.61	4.1	3.96	4.3	3.77	4.06		0	0
Milepost	179	to 180	2	61.39	5.00	2	55.19	7.00	3.96	4.0	4.05	3.8	3.97	3.84		0	0
Milepost	180	to 181	2	48.55	2.00	2	65.99	6.00	4.16	4.5	3.89	3.9	4.25	3.88		0	0
Milepost	181	to 182	2	77.50	1.00	2	57.80	6.00	3.72	4.7	4.01	3.9	4.00	3.92		0	0
Milepost	182	to 183	2	60.92	5.00	2	73.33	7.00	3.97	4.0	3.78	3.8	3.98	3.76		0	0
Milepost	183	to 184	2	57.40	2.00	2	68.91	5.00	4.02	4.5	3.85	4.0	4.15	3.89		0	0
		Total	16			16											0
			Weighted Average						3.86	4.20	3.95	3.96	3.96	3.93			
			Factor						1.00		1.00						
			Indicator Score						**3.86**		**3.95**						**0.0%**
			Pavement Index												**3.95**		
Segment 5		***Interstate?***	**No**														
Milepost	184	to 185	2	69.82	2.00	2	55.47	6.00	3.83	4.5	4.05	3.9	4.02	3.93		0	0
Milepost	185	to 186	2	145.44	3.00	2	65.84	3.00	2.88	4.3	3.89	4.3	2.88	4.01		2	0
Milepost	186	to 187	2	62.29	2.00	2	55.43	2.00	3.95	4.5	4.05	4.5	4.10	4.17		0	0
Milepost	187	to 188	2	48.94	3.00	2	56.94	4.00	4.15	4.3	4.03	4.1	4.19	4.06		0	0
Milepost	188	to 189	2	59.08	2.00	2	51.23	2.00	3.99	4.5	4.12	4.5	4.13	4.22		0	0
		Total	10			10											2
			Weighted Average						3.76	4.39	4.03	4.24	3.86	4.08			
			Factor						1.00		1.00						
			Indicator Score						**3.76**		**4.03**						**10.0%**
			Pavement Index												**3.97**		

Bridge Performance Area Data

Structure Name (A209)	Structure # (N8)	Milepost (A232)	Area (A225)	Bridge Sufficiency	Bridge Index					Functionally Obsolete Bridges	Bridge Rating	Hot Spots on Bridge Index map
				Sufficiency Rating	Deck (N58)	Sub (N59)	Super (N60)	Eval (N67)	Lowest	Deck Area on Func Obsolete		
Segment 1												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			
Segment 2												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			
Segment 3												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			
Segment 4												
Gila River Bridge NB	00991	181.79	59094	98.80	6.00	7.00	6.00	6.00	6.0	0		
Gila River Br SB	02401	181.79	56636	98.40	6.00	7.00	8.00	7.00	6.0	0		
Santa Cruz Wash NB	02353	178.3	7741	98.80	7.00	8.00	7.00	7.00	7.0	0		
Santa Cruz Wash SB	02490	178.3	7458	98.40	6.00	8.00	7.00	7.00	6.0	0		
Santa Cruz Wash NB	02354	176.19	11470	98.80	7.00	7.00	7.00	7.00	7.0	0		
Santa Cruz Wash SB	02485	176.19	11074	98.40	7.00	8.00	7.00	7.00	7.0	0		
Total			153,473									
Weighted Average				98.60					6.20	0.00%		
Factor				1.00					1.00	1.00		
Indicator Score				**98.60**						**0.00%**	**6**	
Bridge Index									**6.20**			
Segment 5												
N/A - No Bridges in Segment		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Total			#N/A									
Weighted Average				#N/A					#N/A	#N/A		
Factor				1.00					1.00	1.00		
Indicator Score				**#N/A**						**#N/A**	**#N/A**	
Bridge Index									**#N/A**			

Mobility Performance Area Data

Segment	Begin MP	End MP	Length (mi)	Facility Type	Flow Type	Terrain	No. of Lanes	Capacity Environment Type	Lane Width (feet)	EB/NB Right Shoulder Width	WB/SB Right Shoulder Width	EB/NB Left Shoulder Width	WB/SB Left Shoulder Width	NB/EB AADT	SB/WB AADT	2015 AADT	K Factor	D Factor	T Factor	Weighted Average Posted Speed Limit	Divided or Undivided	Access Points (per mile)	% No-Passing Zone	Street Parking
1	155.1	162	6.9	Rural	Interrupted	Level	2	Rural Two-Lane, Non-Signalized	12.00	5.59	5.12	N/A	N/A	721	702	1422.62	13.87%	50.97%	11.68%	54	Undivided	1.739	22%	N/A
2	162	171	9	Rural	Interrupted	Level	4	Multilane Highway	12.00	9.86	9.86	9.86	3.86	2822	2805	5626.56	8.28%	50.37%	12.39%	60	Divided	0.889	0%	N/A
3	171	176	5	Fringe Urban	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	5.67	3.41	N/A	N/A	12635	12650	25285.5	8.99%	50.36%	6.51%	41	Divided	N/A	0%	N/A
4	176	184	8	Rural	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	9.63	10.00	N/A	N/A	19791	20335	40126	9.00%	50.68%	8.70%	61	Divided	N/A	0%	N/A
5	184	189.38	5.38	Rural	Interrupted	Level	4	Urban/Rural Single or Multilane Signalized	12.00	9.14	9.10	N/A	N/A	18533	18273	36805.7	8.59%	50.79%	8.93%	59	Divided	N/A	0%	N/A

Car TTI and PTI/Truck TTTI and TPTI – Northbound/Eastbound

Segment	TMC	timeperiod	week_type	ROAD_NUMBER	road_direction	cars_mean	trucks_mean	cars_P05	trucks_P05	Posted Speed limit	Assumed car free-flow speed	Assumed truck free-flow speed	cars_TTI	Trucks_TTI	cars_PTI	Trucks_PTI	Cars_PeakTTI	Trucks_PeakTTI	Cars_PeakPTI	Trucks_PeakPTI
1	115N07250	1 AM Peak	Weekday	AZ-84	Southbound	54.2	51.9	19.9	21.8	54	54	54	1.00	1.04	2.72	2.48	1.00	1.04	2.72	2.63
1	115N07250	2 Mid Day	Weekday	AZ-84	Southbound	55.1	52.3	23.0	20.5	54	54	54	1.00	1.03	2.35	2.63				
1	115N07250	3 PM Peak	Weekday	AZ-84	Southbound	57.1	52.7	32.9	26.0	54	54	54	1.00	1.02	1.64	2.07				
1	115N07250	4 Evening	Weekday	AZ-84	Southbound	54.9	51.1	19.0	27.5	54	54	54	1.00	1.06	2.84	1.96				
1	115P07295	1 AM Peak	Weekday	AZ-347	Northbound	58.6	59.0	34.8	40.4	45	45	45	1.00	1.00	1.29	1.11	1.00	1.00	1.39	1.25
1	115P07295	2 Mid Day	Weekday	AZ-347	Northbound	59.2	58.2	32.3	36.0	45	45	45	1.00	1.00	1.39	1.25				
1	115P07295	3 PM Peak	Weekday	AZ-347	Northbound	60.5	57.8	34.2	36.7	45	45	45	1.00	1.00	1.32	1.23				
1	115P07295	4 Evening	Weekday	AZ-347	Northbound	61.4	58.3	33.9	38.3	45	45	45	1.00	1.00	1.33	1.17				
2	115P07295	1 AM Peak	Weekday	AZ-347	Northbound	58.6	59.0	34.8	40.4	45	45	45	1.00	1.00	1.29	1.11	1.00	1.00	1.39	1.25
2	115P07295	2 Mid Day	Weekday	AZ-347	Northbound	59.2	58.2	32.3	36.0	45	45	45	1.00	1.00	1.39	1.25				
2	115P07295	3 PM Peak	Weekday	AZ-347	Northbound	60.5	57.8	34.2	36.7	45	45	45	1.00	1.00	1.32	1.23				
2	115P07295	4 Evening	Weekday	AZ-347	Northbound	61.4	58.3	33.9	38.3	45	45	45	1.00	1.00	1.33	1.17				
2	115P07296	1 AM Peak	Weekday	AZ-347	Northbound	32.0	38.5	5.6	10.6	45	45	45	1.40	1.17	8.05	4.26	1.43	1.28	8.05	6.21
2	115P07296	2 Mid Day	Weekday	AZ-347	Northbound	31.4	35.1	5.6	7.2	45	45	45	1.43	1.28	8.05	6.21				
2	115P07296	3 PM Peak	Weekday	AZ-347	Northbound	31.7	35.7	6.8	9.9	45	45	45	1.42	1.26	6.58	4.52				
2	115P07296	4 Evening	Weekday	AZ-347	Northbound	35.4	36.8	8.7	11.8	45	45	45	1.27	1.22	5.17	3.81				
3	115P07296	1 AM Peak	Weekday	AZ-347	Northbound	32.0	38.5	5.6	10.6	45	45	45	1.40	1.17	8.05	4.26	1.43	1.28	8.05	6.21
3	115P07296	2 Mid Day	Weekday	AZ-347	Northbound	31.4	35.1	5.6	7.2	45	45	45	1.43	1.28	8.05	6.21				
3	115P07296	3 PM Peak	Weekday	AZ-347	Northbound	31.7	35.7	6.8	9.9	45	45	45	1.42	1.26	6.58	4.52				
3	115P07296	4 Evening	Weekday	AZ-347	Northbound	35.4	36.8	8.7	11.8	45	45	45	1.27	1.22	5.17	3.81				
3	115P07297	1 AM Peak	Weekday	AZ-347	Northbound	25.9	23.6	5.9	6.8	35	35	35	1.35	1.48	5.96	5.12	1.58	1.71	7.04	9.39
3	115P07297	2 Mid Day	Weekday	AZ-347	Northbound	23.2	21.2	6.0	5.0	35	35	35	1.51	1.65	5.86	7.04				
3	115P07297	3 PM Peak	Weekday	AZ-347	Northbound	22.1	20.5	5.0	3.7	35	35	35	1.58	1.71	7.04	9.39				
3	115P07297	4 Evening	Weekday	AZ-347	Northbound	26.1	23.9	5.6	6.8	35	35	35	1.34	1.47	6.26	5.12				
3	115P07298	1 AM Peak	Weekday	AZ-347	Northbound	48.6	41.2	21.9	10.5	60	60	60	1.24	1.46	2.74	5.74	1.29	1.50	3.31	8.40
3	115P07298	2 Mid Day	Weekday	AZ-347	Northbound	49.0	42.7	26.7	10.6	60	60	60	1.22	1.41	2.25	5.68				
3	115P07298	3 PM Peak	Weekday	AZ-347	Northbound	46.6	39.9	18.1	7.1	60	60	60	1.29	1.50	3.31	8.40				
3	115P07298	4 Evening	Weekday	AZ-347	Northbound	51.5	44.6	23.6	15.5	60	60	60	1.17	1.35	2.54	3.86				
4	115P07298	1 AM Peak	Weekday	AZ-347	Northbound	48.6	41.2	21.9	10.5	60	60	60	1.24	1.46	2.74	5.74	1.29	1.50	3.31	8.40
4	115P07298	2 Mid Day	Weekday	AZ-347	Northbound	49.0	42.7	26.7	10.6	60	60	60	1.22	1.41	2.25	5.68				
4	115P07298	3 PM Peak	Weekday	AZ-347	Northbound	46.6	39.9	18.1	7.1	60	60	60	1.29	1.50	3.31	8.40				
4	115P07298	4 Evening	Weekday	AZ-347	Northbound	51.5	44.6	23.6	15.5	60	60	60	1.17	1.35	2.54	3.86				
4	115P07299	1 AM Peak	Weekday	AZ-347	Northbound	52.9	44.7	19.8	10.6	63	63	63	1.19	1.41	3.19	5.96	1.19	1.41	3.19	12.67

4	115P07299	2 Mid Day	Weekday	AZ-347	Northbound	62.4	54.8	46.9	20.5	63	63	63	1.01	1.15	1.34	3.07				
4	115P07299	3 PM Peak	Weekday	AZ-347	Northbound	62.1	51.6	40.0	5.0	63	63	63	1.02	1.22	1.57	12.67				
4	115P07299	4 Evening	Weekday	AZ-347	Northbound	63.9	57.1	49.8	30.5	63	63	63	1.00	1.10	1.27	2.07				
5	115P07299	1 AM Peak	Weekday	AZ-347	Northbound	52.9	44.7	19.8	10.6	63	63	63	1.19	1.41	3.19	5.96	1.19	1.41	3.19	12.67
5	115P07299	2 Mid Day	Weekday	AZ-347	Northbound	62.4	54.8	46.9	20.5	63	63	63	1.01	1.15	1.34	3.07				
5	115P07299	3 PM Peak	Weekday	AZ-347	Northbound	62.1	51.6	40.0	5.0	63	63	63	1.02	1.22	1.57	12.67				
5	115P07299	4 Evening	Weekday	AZ-347	Northbound	63.9	57.1	49.8	30.5	63	63	63	1.00	1.10	1.27	2.07				
5	115P07300	1 AM Peak	Weekday	AZ-347	Northbound	53.1	41.8	27.9	11.2	60	60	60	1.13	1.43	2.15	5.36	1.13	1.43	2.91	5.68
5	115P07300	2 Mid Day	Weekday	AZ-347	Northbound	54.2	44.6	28.4	11.4	60	60	60	1.11	1.35	2.11	5.26				
5	115P07300	3 PM Peak	Weekday	AZ-347	Northbound	53.8	45.3	21.3	12.4	60	60	60	1.11	1.32	2.81	4.83				
5	115P07300	4 Evening	Weekday	AZ-347	Northbound	53.7	44.5	20.6	10.6	60	60	60	1.12	1.35	2.91	5.68				

Car TTI and PTI/Truck TTTI and TPTI – Southbound/Westbound

Segment	TMC	timeperiod	week_type	ROAD_NUMBER	road_direction	cars_mean	trucks_mean	cars_P05	trucks_P05	Posted Speed limit	Assumed car free-flow speed	Assumed truck free-flow speed	cars_TTI	Trucks_TTI	cars_PTI	Trucks_PTI	Cars_PeakTTI	Trucks_PeakTTI	Cars_PeakPTI	Trucks_PeakPTI
1	115P07251	1 AM Peak	Weekday	AZ-84	Northbound	53.8	50.5	21.7	20.5	54	54	54	1.00	1.07	2.48	2.63	1.07	1.13	3.62	3.00
1	115P07251	2 Mid Day	Weekday	AZ-84	Northbound	54.6	51.9	27.0	26.3	54	54	54	1.00	1.04	2.00	2.05				
1	115P07251	3 PM Peak	Weekday	AZ-84	Northbound	52.6	51.6	24.9	24.2	54	54	54	1.03	1.05	2.17	2.23				
1	115P07251	4 Evening	Weekday	AZ-84	Northbound	50.7	47.9	14.9	18.0	54	54	54	1.07	1.13	3.62	3.00				
1	115N07294	1 AM Peak	Weekday	AZ-347	Southbound	59.8	59.2	35.6	40.1	64	64	64	1.07	1.08	1.80	1.60	1.08	1.14	2.10	1.99
1	115N07294	2 Mid Day	Weekday	AZ-347	Southbound	59.3	56.6	35.4	32.1	64	64	64	1.08	1.13	1.81	1.99				
1	115N07294	3 PM Peak	Weekday	AZ-347	Southbound	60.0	56.0	34.2	34.8	64	64	64	1.07	1.14	1.87	1.84				
1	115N07294	4 Evening	Weekday	AZ-347	Southbound	59.3	57.9	30.4	36.7	64	64	64	1.08	1.11	2.10	1.75				
2	115N07295	1 AM Peak	Weekday	AZ-347	Southbound	38.9	41.3	16.8	15.7	55	55	55	1.41	1.33	3.28	3.49	1.44	1.37	4.02	4.02
2	115N07295	2 Mid Day	Weekday	AZ-347	Southbound	39.6	41.5	16.8	16.8	55	55	55	1.39	1.32	3.28	3.28				
2	115N07295	3 PM Peak	Weekday	AZ-347	Southbound	39.1	40.1	13.7	13.7	55	55	55	1.41	1.37	4.02	4.02				
2	115N07295	4 Evening	Weekday	AZ-347	Southbound	38.3	40.2	14.9	13.7	55	55	55	1.44	1.37	3.69	4.02				
2	115N07294	1 AM Peak	Weekday	AZ-347	Southbound	59.8	59.2	35.6	40.1	64	64	64	1.07	1.08	1.80	1.60	1.08	1.14	2.10	1.99
2	115N07294	2 Mid Day	Weekday	AZ-347	Southbound	59.3	56.6	35.4	32.1	64	64	64	1.08	1.13	1.81	1.99				
2	115N07294	3 PM Peak	Weekday	AZ-347	Southbound	60.0	56.0	34.2	34.8	64	64	64	1.07	1.14	1.87	1.84				
2	115N07294	4 Evening	Weekday	AZ-347	Southbound	59.3	57.9	30.4	36.7	64	64	64	1.08	1.11	2.10	1.75				
3	115N07296	1 AM Peak	Weekday	AZ-347	Southbound	26.8	24.9	7.5	6.8	35	35	35	1.31	1.41	4.69	5.12	1.47	1.74	6.25	14.08
3	115N07296	2 Mid Day	Weekday	AZ-347	Southbound	24.3	22.2	7.5	5.0	35	35	35	1.44	1.58	4.69	7.04				
3	115N07296	3 PM Peak	Weekday	AZ-347	Southbound	23.7	20.1	6.8	2.5	35	35	35	1.47	1.74	5.12	14.08				
3	115N07296	4 Evening	Weekday	AZ-347	Southbound	26.4	24.4	5.6	5.0	35	35	35	1.32	1.43	6.25	7.04				
3	115N07297	1 AM Peak	Weekday	AZ-347	Southbound	48.9	44.9	25.5	9.1	60	60	60	1.23	1.34	2.36	6.58	1.37	1.63	3.25	12.07
3	115N07297	2 Mid Day	Weekday	AZ-347	Southbound	46.6	40.1	19.3	5.6	60	60	60	1.29	1.50	3.12	10.73				
3	115N07297	3 PM Peak	Weekday	AZ-347	Southbound	43.6	36.8	18.5	5.0	60	60	60	1.37	1.63	3.25	12.07				
3	115N07297	4 Evening	Weekday	AZ-347	Southbound	49.1	44.7	19.2	8.7	60	60	60	1.22	1.34	3.13	6.89				
3	115N07295	1 AM Peak	Weekday	AZ-347	Southbound	38.9	41.3	16.8	15.7	55	55	55	1.41	1.33	3.28	3.49	1.44	1.37	4.02	4.02
3	115N07295	2 Mid Day	Weekday	AZ-347	Southbound	39.6	41.5	16.8	16.8	55	55	55	1.39	1.32	3.28	3.28				
3	115N07295	3 PM Peak	Weekday	AZ-347	Southbound	39.1	40.1	13.7	13.7	55	55	55	1.41	1.37	4.02	4.02				
3	115N07295	4 Evening	Weekday	AZ-347	Southbound	38.3	40.2	14.9	13.7	55	55	55	1.44	1.37	3.69	4.02				
4	115N07298	1 AM Peak	Weekday	AZ-347	Southbound	62.8	57.3	50.8	31.7	58	58	58	1.00	1.01	1.14	1.83	1.00	1.05	1.23	2.17
4	115N07298	2 Mid Day	Weekday	AZ-347	Southbound	63.4	56.9	50.3	30.1	58	58	58	1.00	1.02	1.15	1.92				
4	115N07298	3 PM Peak	Weekday	AZ-347	Southbound	61.8	55.3	47.0	26.7	58	58	58	1.00	1.05	1.23	2.17				
4	115N07298	4 Evening	Weekday	AZ-347	Southbound	63.5	58.0	49.6	37.1	58	58	58	1.00	1.00	1.17	1.56				
4	115N07297	1 AM Peak	Weekday	AZ-347	Southbound	48.9	44.9	25.5	9.1	60	60	60	1.23	1.34	2.36	6.58	1.37	1.63	3.25	12.07
4	115N07297	2 Mid Day	Weekday	AZ-347	Southbound	46.6	40.1	19.3	5.6	60	60	60	1.29	1.50	3.12	10.73				

4	115N07297	3 PM Peak	Weekday	AZ-347	Southbound	43.6	36.8	18.5	5.0	60	60	60	1.37	1.63	3.25	12.07				
4	115N07297	4 Evening	Weekday	AZ-347	Southbound	49.1	44.7	19.2	8.7	60	60	60	1.22	1.34	3.13	6.89				
5	115N07299	1 AM Peak	Weekday	AZ-347	Southbound	56.1	49.9	35.1	14.9	60	60	60	1.07	1.20	1.71	4.02	1.31	1.53	4.41	8.04
5	115N07299	2 Mid Day	Weekday	AZ-347	Southbound	56.9	49.1	33.5	13.7	60	60	60	1.06	1.22	1.79	4.39				
5	115N07299	3 PM Peak	Weekday	AZ-347	Southbound	45.9	39.1	13.6	7.5	60	60	60	1.31	1.53	4.41	8.04				
5	115N07299	4 Evening	Weekday	AZ-347	Southbound	56.4	50.0	21.7	14.9	60	60	60	1.06	1.20	2.76	4.02				
5	115N07298	1 AM Peak	Weekday	AZ-347	Southbound	62.8	57.3	50.8	31.7	59	59	59	1.00	1.03	1.16	1.86	1.00	1.07	1.26	2.21
5	115N07298	2 Mid Day	Weekday	AZ-347	Southbound	63.4	56.9	50.3	30.1	59	59	59	1.00	1.04	1.17	1.96				
5	115N07298	3 PM Peak	Weekday	AZ-347	Southbound	61.8	55.3	47.0	26.7	59	59	59	1.00	1.07	1.26	2.21				
5	115N07298	4 Evening	Weekday	AZ-347	Southbound	63.5	58.0	49.6	37.1	59	59	59	1.00	1.02	1.19	1.59				

Closure Data

				Total miles of closures		Avg Occurrences/Mile/Year	
Segment	Length (miles)	# of closures	# F&I	EB/NB	SB/WB	EB/NB	SB/WB
1	7	1	1	1.0	0.0	0.03	0.00
2	9	10	4	4.0	6.0	0.09	0.13
3	5	7	3	4.0	3.0	0.16	0.12
4	8	14	7	9.5	6.0	0.24	0.15
5	5	18	10	15.2	3.0	0.61	0.12

	ITIS Category Description											
	Closures		Incidents/Accidents		Incidents/Crashes		Obstruction Hazards		Winds		Winter Storm Codes	
Segment	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB
1	0	0	1	0	0	0	0	0	0	0	0	0
2	0	0	4	6	0	0	0	0	0	0	0	0
3	0	0	4	3	0	0	0	0	0	0	0	0
4	0	0	8	5	0	0	0	1	0	0	0	0
5	0	0	14	3	0	0	0	0	0	0	1	0

HPMS Data

2011-2015 AVERAGE HPMS DATA					
WEIGHTED AVERAGES					
SEGMENT	MP_FROM	MP_TO	WEIGHTED AVERAGE NB/EB AADT	WEIGHTED AVERAGE SB/WB AADT	WEIGHTED AVERAGE AADT
347/84-1	155	162	678	679	1358
347-2	162	171	2474	2551	5025
347-3	171	176	12368	12926	25294
347-4	176	184	18117	18215	36332
347-5	184	189	17737	17661	35398

For Mobility					
2015					
NB/EB AADT	SB/WB AADT	2015 AADT	K Factor	D-Factor	T-Factor
721	702	1423	14	51	12
2822	2805	5627	8	50	12
12635	12650	25286	9	50	7
19791	20335	40126	9	51	9
18533	18273	36806	9	51	9

SEGMENT	Loc ID	BMP	EMP	Length	Pos Dir AADT	Neg Dir AADT	Corrected Pos Dir AADT	Corrected Neg Dir AADT	2015 AADT	K Factor	D-Factor	D-Factor Adjusted	T-Factor
347/84-1	100899	155.13	160.88	5.75	545	521	545	521	1066	15	67	51	11
	101614	160.89	162.00	1.11	1630	1640	1630	1640	3270	8	62	50	15
347-2	101614	162.00	165.34	3.34	1630	1640	1630	1640	3270	8	62	50	15
	101615	165.34	168.51	3.17	1734	1674	1734	1674	3408	8	51	51	15
	101616	168.51	171.00	2.49	2903	6253	5806	5806	11612	9	55	50	6
347-3	101617	171.50	171.99	0.49	6384	6400	6384	6400	12785	10	56	50	5
	102292	171.99	172.51	0.52	0	0	6900	6900	13800	9	59	50	6
	102293	172.51	173.16	0.65	8151	7962	8151	7962	16113	9	59	51	7
	102294	173.16	173.46	0.30	11940	10869	11940	10869	22809	9	57	52	6
	101618	173.46	174.00	0.54	13310	14183	15000	15000	30000	9	55	50	5
	101620	174.00	174.56	0.56	11340	16328	17000	17000	34000	8	61	50	5
	101621	174.56	175.65	1.09	18469	18761	18469	18761	37230	9	71	50	9
	101616	171.00	171.50	0.50	2903	6253	5806	5806	11612	9	55	50	6
	101622	175.65	176.00	0.35	19791	20335	19791	20335	40126	9	70	51	9
347-4	101622	176.00	184.00	8.00	19791	20335	19791	20335	40126	9	70	51	9
347-5	101623	185.28	187.51	2.23	18706	7897	19958	19958	39916	8	57	50	9
	101624	187.51	189.38	1.87	15972	14852	15972	14852	30824	9	69	52	9
	101622	184.00	185.28	1.28	19791	20335	19791	20335	40126	9	70	51	9

Bicycle Accommodation Data

Segment	BMP	EMP	Divided or Non	NB/EB Right Shoulder Width	SB/WB Right Shoulder Width	NB/EB Left Shoulder Width	SB/WB Left Shoulder Width	NB/EB Effective Length of Shoulder	SB/WB Effective Length of Shoulder	% Bicycle Accommodation
1	155.1	162	Undivided	5.6	5.1	N/A	N/A	6.9	6.9	100%
2	162	171	Divided	9.9	9.9	3.9	3.9	9.0	9.0	100%
3	171	176	Divided	5.7	3.4	1.0	2.1	2.9	1.4	43%
4	176	184	Divided	9.6	10.0	4.0	4.0	7.6	8.0	98%
5	184	189.38	Divided	9.1	9.1	3.9	5.7	5.3	5.2	98%

AZTDM Data

SEGMENT	Growth Rate	% Non-SOV
1	5.16%	19.9%
2	2.90%	20.2%
3	3.02%	19.1%
4	1.95%	9.4%
5	1.96%	9.3%

Safety Performance Area Data

Segment	Segment Similar Operating Environment Type	Segment NB/EB Fatal Crashes	Segment SB/WB Fatal Crashes	Segment NB/EB Incapacitating Injury Crashes	Segment SB/WB Incapacitating Injury Crashes	Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	Fatal + Incapacitating Injury Crashes Involving Trucks	Fatal + Incapacitating Injury Crashes Involving Motorcycles	Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Weighted Average NB/EB AADT	Weighted Average SB/WB AADT	Weighted Average Total AADT
84/347-1	2 or 3 Lane Undivided Highway	0	0	0	3	2	0	0	0	678	679	1358
347-2	2 or 3 or 4 Lane Divided Highway	1	1	0	3	3	0	0	1	2474	2551	5025
347-3	2 or 3 or 4 Lane Divided Highway	0	0	1	1	1	0	0	0	12368	12926	25294
347-4	2 or 3 or 4 Lane Divided Highway	1	2	2	5	8	0	0	0	18117	18215	36332
347-5	2 or 3 or 4 Lane Divided Highway	1	3	5	12	10	2	1	1	17737	17661	35398

HPMS Data

2011-2015 AVERAGE HPMS DATA

WEIGHTED AVERAGES for Safety					
SEGMENT	MP_FROM	MP_TO	WEIGHTED AVERAGE NB/EB AADT	WEIGHTED AVERAGE SB/WB AADT	WEIGHTED AVERAGE AADT
347/84-1	155	162	678	679	1358
347-2	162	171	2474	2551	5025
347-3	171	176	12368	12926	25294
347-4	176	184	18117	18215	36332
347-5	184	189	17737	17661	35398

2015			2014			2013			2012			2011		
NB/EB AADT	SB/WB AADT	2015 AADT	NB/EB AADT	SB/WB AADT	2014 AADT	NB/EB AADT	SB/WB AADT	2013 AADT	NB/EB AADT	SB/WB AADT	2012 AADT	NB/EB AADT	SB/WB AADT	2011 AADT
721	702	1423	688	667	1357	598	614	1212	636	643	1279	748	771	1520
2822	2805	5627	2894	2901	5796	3015	3390	6404	1539	1559	3099	2099	2099	4198
12635	12650	25286	13349	13565	26914	13699	14455	28154	13172	13200	26372	8984	10762	19746
19791	20335	40126	16481	20806	37287	18839	14372	33211	16609	16609	33218	18866	18952	37816
18533	18273	36806	17073	17566	34639	17705	16834	34539	17580	17719	35300	17796	17913	35708

Freight Performance Area Data

				Total minutes of closures		Avg Mins/Mile/Year	
Segment	Length (miles)	# of closures	# F&I	EB/NB	SB/WB	EB/NB	SB/WB
1	7	1	1	222.0	0.0	6.34	0.00
2	9	10	4	600.0	1092.0	13.33	24.27
3	5	7	3	729.0	235.0	29.16	9.40
4	8	14	7	1623.5	810.0	40.59	20.25
5	5	18	10	2670.0	274.0	106.80	10.96

	ITIS Category Description											
	Closures		Incidents/Accidents		Incidents/Crashes		Obstruction Hazards		Winds		Winter Storm Codes	
Segment	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB	EB/NB	SB/WB
1	0	0	1	0	0	0	0	0	0	0	0	0
2	0	0	4	6	0	0	0	0	0	0	0	0
3	0	0	4	3	0	0	0	0	0	0	0	0
4	0	0	8	5	0	0	0	1	0	0	0	0
5	0	0	14	3	0	0	0	0	0	0	1	0

See the **Mobility Performance Area Data** section for other Freight Performance Area related data.

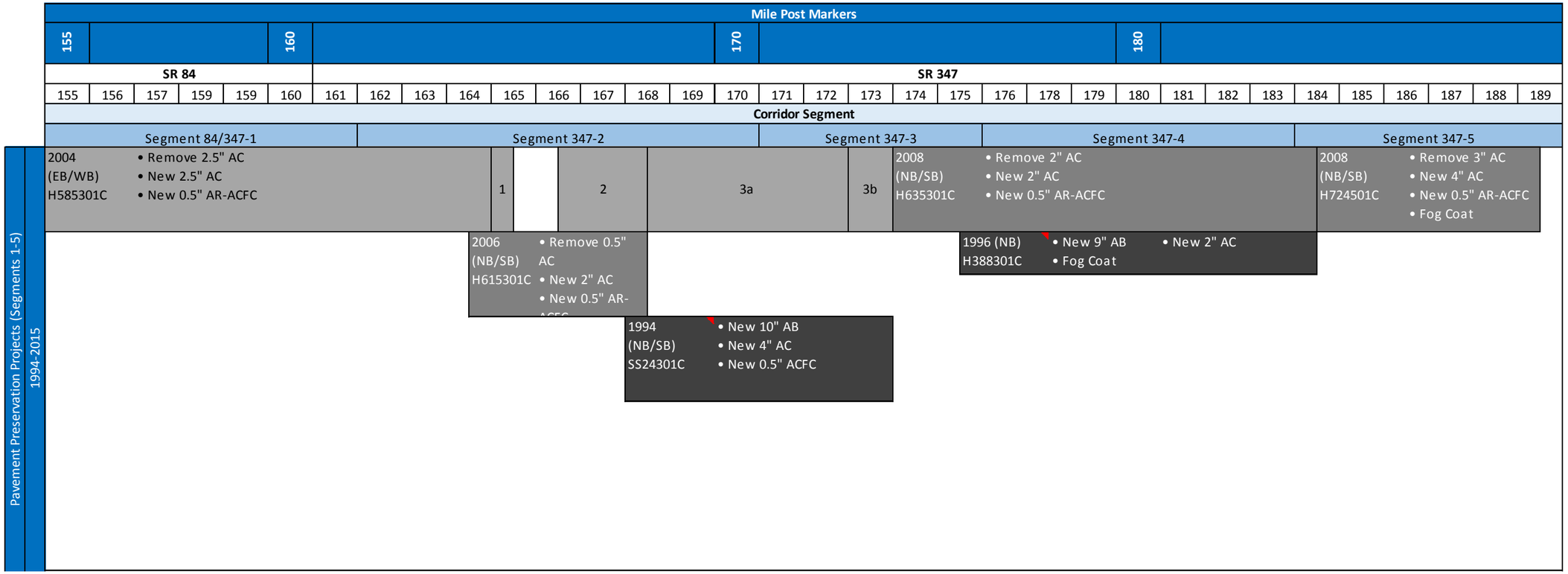
Appendix D: Needs Analysis Contributing Factors and Scores

Pavement Performance Needs Analysis

Segment Length (miles)	Segment Mileposts (MP)	Final Need	Bid History Investment	PeCos History Investment	Resulting Historical Investment	Contributing Factors and Comments
7	155-162	None	Low	Low	Low	
9	162-171	Low	Medium	Low	Medium	Hot spot NB MP 162-164
5	171-176	Low	High	Low	High	Hot spot NB MP 173-175
8	176-184	None	High	Low	High	
5	184-189	Low	Low	N/A	Low	Hot spot NB MP 185-186

Pavement History

SR 84/SR 347 Pavement History



Pavement Treatment Reference Numbers
1. 2011 (NB/SB) H827101C: Remove 0.5", 0.5" ACFC
2. 2000 (NB/SB) H559101C: Remove 3", 3" AC
3 a. 2012 (NB/SB) H810801C: Remove 3", 2.5" AC, 0.5" AR-ACFC
3 b. 2012 (NB/SB) H810801C: Remove 3", 3" AC

Legend

- New Paving or Reconstruction
- Mill and Overlay (Adding Structural Thickness)
- Mill and Replace (No Change Structural Thickness)
- Fog Coat or Thin Overlay Treatments
- PCCP Pavement Border
- AC Pavement Border

Value	Level	Segment Number									
		1		2		3		4		5	
		Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir	Uni-Dir	Bi-Dir
1	L1										
1											
1											
1											
3	L2		100%		89%		60%				
3											
3											
3											
3											
3											
4	L3				44%		40%		100%		83%
4											
4											
4											
6	L4				33%	10%	60%	100%		8%	
6											
6											
6											
6											
6											
Sub-Total		0.0	3.0	0.0	6.4	0.6	7.0	6.0	4.0	0.5	3.3
Total		**3.0**		**6.4**		**7.3**		**7.0**		**3.6**	

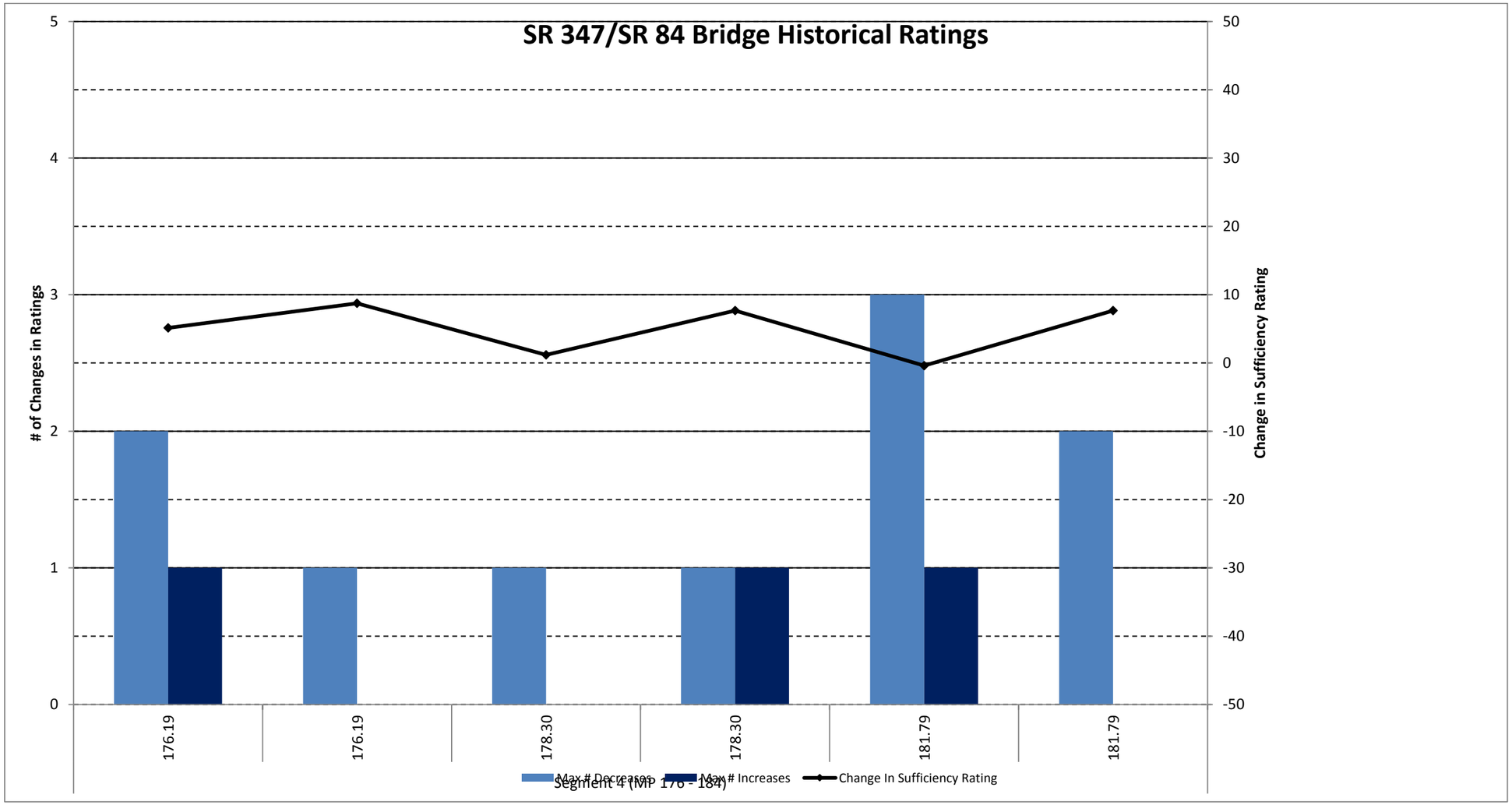
Pavement Bid History Investment (Standard Calculation Level Totals)

Value	Level	Segment Number				
		1	**2**	**3**	**4**	**5**
1	L1	0.0	0.0	0.0	0.0	0.0
3	L2	3.0	2.7	1.8	0.0	0.0
4	L3	0.0	1.8	1.6	4.0	3.3
6	L4	0.0	2.0	3.9	3.0	0.3
Total		3.0	6.4	7.3	7.0	3.6

Bridge Performance Needs Analysis

Segment Length (Miles)	Segment Mileposts (MP)	Number of Bridges in Segment	# Functionally Obsolete Bridges	Final Need	Contributing Factors			Comments
					Bridge	Current Ratings	Historical Review	
7	155-162	0	0	None	No bridges with current ratings less than 6 and no historical issues			
9	162-171	0	0	None	No bridges with current ratings less than 6 and no historical issues			
5	171-176	0	0	None	No bridges with current ratings less than 6 and no historical issues			
8	176-184	6	0	None	No bridges with current ratings less than 6		Gila River Bridge NB (3 decreases in the deck rating)	
5	184-189	0	0	None	No bridges with current ratings less than 6 and no historical issues			

Bridge Ratings History



O identifies the bridge indicated is of concern from a historical ratings perspective

Maximum # of Decreases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating decreased from 1997 to 2014. (Higher number could indicate a more dramatic decline in the performance of the bridge)

Maximum # of Increases: Maximum number of times that the Deck Rating, Substructure Rating, or Superstructure Rating increased from 1997 to 2014. (Higher number could indicate a higher level of investment)

Change in Sufficiency Rating: Cumulative change in Sufficiency Rating from 1997 to 2014. (Bigger negative number could indicate a more dramatic decline in the performance of the bridge)

Mobility Performance Needs Analysis

Segment #	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Roadway Variables								Traffic Variables					Relevant Mobility Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB Buffer Index (PTI-TTI)	SB Buffer Index (PTI-TTI)	
84/347-1	155-162	7	None	State Highway	Rural	Level	2	40-65	No	Non-Divided	20%	A/B	A/B	13%	1.05	1.79	Grade-separated traffic interchange (I-8 & SR 84)
347-2	162-171	9	Low	State Highway	Rural	Level	4	45-65	No	Divided	0%	A/B	A/B	12%	3.50	1.81	
347-3	171-176	5	High	State Highway	Fringe Urban	Level	4	35-45	No	Divided	0%	E/F	E/F	6%	4.70	3.08	At-grade railroad crossing MP 173.4; permanent traffic counter at MP 171.4
347-4	176-184	8	High	State Highway	Rural	Level	4	55-65	No	Divided	0%	D-F	D-F	9%	2.01	1.05	
347-5	184-189	5	High	State Highway	Rural	Level	4	45-65	No	Divided	0%	D-F	D-F	9%	1.89	1.68	Grade-separated traffic interchange (I-10 & SR 347)

Segment #	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
84/347-1	155-162	7	None	1	1	100%	0	0%	0	0%			Percentage of closures due to incidents/accidents above the statewide average (100% to 96%)
347-2	162-171	9	Low	10	10	100%	0	0%	0	0%			Percentage of closures due to incidents/accidents above the statewide average (100% to 96%)
347-3	171-176	5	High	7	7	100%	0	0%	0	0%		Grade separated railroad crossing with bike lanes and sidewalks (2017)	Percentage of closures due to incidents/accidents above the statewide average (100% to 96%)
347-4	176-184	8	High	14	13	93%	1	7%	0	0%			Percentage of closures due to obstructions/hazards above the statewide average (7% to 3%)
347-5	184-189	5	High	18	17	94%	0	0%	1	6%			Percentage of closures due to weather above the statewide average (6% to 1%)

Safety Performance Needs Analysis

		Segment Number	84/347-1	347-2	347-3	347-4	347-5	Corridor-Wide Crash Characteristics
		Segment Length (miles)	7	9	5	8	5	
		Segment Milepost (MP)	155-162	162-171	171-176	176-184	184-189	
		Final Need	None	Medium	None	Low	High	
		Segment Crash Overview	**0** Crashes were fatal **3** Crashes had incapacitating injuries **0** Crashes involve trucks **0** Crashes involve Motorcycles	**2** Crashes were fatal **3** Crashes had incapacitating injuries **0** Crashes involve trucks **0** Crashes involve Motorcycles	**0** Crashes were fatal **2** Crashes had incapacitating injuries **0** Crashes involve trucks **0** Crashes involve Motorcycles	**3** Crashes were fatal **7** Crashes had incapacitating injuries **0** Crashes involve trucks **0** Crashes involve Motorcycles	**4** Crashes were fatal **17** Crashes had incapacitating injuries **2** Crashes involve trucks **1** Crashes involve Motorcycles	9 Crashes were fatal 32 Crashes had incapacitating injuries 2 Crashes involve trucks 1 Crashes involve Motorcycles
Segment Crash Summaries (Fatal and Serious Injury Crashes)		First Harmful Event Type	N/A - Sample size too small	40% Involve Collision with Motor Vehicle 40% Involve Overturning 20% Involve Collision with Pedestrian	N/A - Sample size too small	60% Involve Collision with Motor Vehicle 40% Involve Overturning	81% Involve Collision with Motor Vehicle 5% Involve Collision with Non-Fixed Object 5% Involve Collision with Animal	68% Involve Collision with Motor Vehicle 17% Involve Overturning 5% Involve Collision with Pedestrian
		Collision Type	N/A - Sample size too small	40% Involve Single Vehicle 20% Involve Left Turn 20% Involve Head On	N/A - Sample size too small	40% Involve Single Vehicle 30% Involve Rear End 20% Involve Angle	67% Involve Rear End 10% Involve Left Turn 10% Involve Sideswipe (same)	41% Involve Rear End 24% Involve Single Vehicle 12% Involve Left Turn
		Violation or Behavior	N/A - Sample size too small	40% Involve Speed too Fast for Conditions 20% Involve Drove in Opposing Lane 20% Involve Failure to Yield Right-of-Way	N/A - Sample size too small	30% Involve Speed too Fast for Conditions 30% Involve Failure to Keep in Proper Lane 10% Involve Unsafe Lane Change	29% Involve Speed too Fast for Conditions 19% Involve Failure to Keep in Proper Lane 19% Involve Inattention/Distraction	27% Involve Speed too Fast for Conditions 17% Involve Failure to Keep in Proper Lane 12% Involve Inattention/Distraction
		Lighting Conditions	N/A - Sample size too small	40% Occur in Dark-Unlighted Conditions 20% Occur in Dark-Unknown Conditions 20% Occur in Dawn Conditions	N/A - Sample size too small	50% Occur in Dark-Unlighted Conditions 50% Occur in Daylight Conditions	43% Occur in Dark-Unlighted Conditions 43% Occur in Daylight Conditions 5% Occur in Dawn Conditions	46% Occur in Dark-Unlighted Conditions 41% Occur in Daylight Conditions 5% Occur in Dawn Conditions
		Surface Conditions	N/A - Sample size too small	80% Involve Dry Conditions 20% Involve Unknown Conditions	N/A - Sample size too small	90% Involve Dry Conditions 10% Involve Wet Conditions	100% Involve Dry Conditions	95% Involve Dry Conditions 2% Involve Wet Conditions 2% Involve Unknown Conditions
		First Unit Event	N/A - Sample size too small	60% Involve a first unit event of Motor Vehicle in Transport 40% Involve a first unit event of Ran Off the Road (Left)	N/A - Sample size too small	60% Involve a first unit event of Motor Vehicle in Transport 20% Involve a first unit event of Ran Off the Road (Left) 10% Involve a first unit event of Equipment Failure	86% Involve a first unit event of Motor Vehicle in Transport 10% Involve a first unit event of Ran Off the Road (Left) 5% Involve a first unit event of Collision with Animal	73% Involve a first unit event of Motor Vehicle in Transport 15% Involve a first unit event of Ran Off the Road (Left) 5% Involve a first unit event of Ran Off the Road (Right)
		Driver Physical Condition	N/A - Sample size too small	60% Under the Influence of Drugs or Alcohol 20% No Apparent Influence 20% Unknown	N/A - Sample size too small	40% Under the Influence of Drugs or Alcohol 20% No Apparent Influence 20% Unknown	76% No Apparent Influence 14% Under the Influence of Drugs or Alcohol 10% Unknown	54% No Apparent Influence 29% Under the Influence of Drugs or Alcohol 12% Unknown
		Safety Device Usage	N/A - Sample size too small	40% None Used 20% Air Bag Deployed/Shoulder-Lap Belt 20% Unknown	N/A - Sample size too small	40% None Used 40% Shoulder And Lap Belt Used 10% Lap Belt Used	62% Shoulder And Lap Belt Used 29% None Used 5% Not Applicable	49% Shoulder And Lap Belt Used 34% None Used 5% Air Bag Deployed/Shoulder-Lap Belt
		Hot Spot Crash Summaries				MP 182-184	MP 184-189	
		Previously Completed Safety-Related Projects			Sidewalk and ADA ramps constructed, MP 172.0-172.5, (2015); Sidewalk enhancements constructed, SR 347 at SR 238, (2014); Sidewalk enhancements constructed, MP 174.6, (2015)		Left-turn lane striping modified at Riggs Road (2017)	
		District Interviews/Discussions	Consistent with District perspective that serious crashes are relatively infrequent in this segment	No comments	Expected to see more crashes here - perhaps the congestion in the City of Maricopa keeps speeds lower, which reduces injury severity in crashes	Expected to see more crashes here - confirm that it is because most crashes do not have severe injuries or fatalities, and not that there is missing crash data	Alignment of sun may be making it hard for drivers to see on the east-west portion of SR 347	
		Contributing Factors	N/A - Sample size too small	-Poor nighttime visibility or lighting -Lack of median barrier -Speed too fast for conditions -Failure to yield right-of-way -Driver inattention/distraction -Lack of crossing opportunity for pedestrians -Misjudgment of speed of oncoming traffic -Not wearing seatbelt -Driving under the influence	N/A - Sample size too small	-Poor nighttime visibility or lighting -Lack of median barrier -Speed too fast for conditions -Failure to yield right-of-way -Disregard of traffic signal -Driver inattention/distraction -Misjudgment of speed of oncoming traffic -Unexpected stops -Lack of traffic signal coordination -Not wearing seatbelt -Driving under the influence -Slippery pavement	-Poor nighttime visibility or lighting -Lack of median barrier -Failure to yield right-of-way -Disregard of traffic signal -Driver inattention/distraction -Misjudgment of speed of oncoming traffic -Unexpected stops -Lack of traffic signal coordination -Not wearing seatbelt	-Poor nighttime visibility or lighting -Lack of median barrier -Failure to yield right-of-way -Disregard of traffic signal -Driver inattention/distraction -Misjudgment of speed of oncoming traffic -Unexpected stops -Lack of traffic signal coordination -Not wearing seatbelt -Driving under the influence

Freight Performance Needs Analysis

Segment #	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Roadway Variables								Traffic Variables					Relevant Freight Related Existing Infrastructure
				Functional Classification	Environmental Type (Urban/Rural)	Terrain	# of Lanes/ Direction	Speed Limit	Aux Lanes	Divided/ Non-Divided	% No Passing	Existing LOS	Future 2035 LOS	% Trucks	NB/EB Buffer Index (TPTI-TTTI)	SB/WB Buffer Index (TPTI-TTTI)	
84/347-1	155-162	7	None	State Highway	Rural	Level	2	40-65	No	Non-Divided	20%	A/B	A/B	13%	0.92	1.36	Grade-separated traffic interchange (I-8 & SR 84)
347-2	162-171	9	None	State Highway	Rural	Level	4	45-65	No	Divided	0%	A/B	A/B	12%	2.59	1.75	
347-3	171-176	5	High	State Highway	FringeUrban	Level	4	35-45	No	Divided	0%	E/F	E/F	6%	6.50	8.48	At-grade railroad crossing MP 173.4; permanent traffic counter at MP 171.4
347-4	176-184	8	High	State Highway	Rural	Level	4	55-65	No	Divided	0%	D-F	D-F	9%	9.08	5.78	
347-5	184-189	5	High	State Highway	Rural	Level	4	45-65	No	Divided	0%	D-F	D-F	9%	7.75	3.82	Grade-separated traffic interchange (I-10 & SR 347)

Segment #	Segment Mileposts (MP)	Segment Length (miles)	Final Need	Closure Extent							Non-Actionable Conditions	Programmed and Planned Projects or Issues from Previous Documents Relevant to Final Need	Contributing Factors
				Total Number of Closures	# Incidents/ Accidents	% Incidents/ Accidents	# Obstructions/ Hazards	% Obstructions/ Hazards	# Weather Related	% Weather Related			
84/347-1	155-162	7	None	1	1	100%	0	0%	0	0%			Percentage of closures due to incidents/accidents above the statewide average (100% to 96%)
347-2	162-171	9	None	10	10	100%	0	0%	0	0%			Percentage of closures due to incidents/accidents above the statewide average (100% to 96%)
347-3	171-176	5	High	7	7	100%	0	0%	0	0%			Percentage of closures due to incidents/accidents above the statewide average (100% to 96%)
347-4	176-184	8	High	14	13	93%	1	7%	0	0%			Percentage of closures due to obstructions/hazards above the statewide average (7% to 3%)
347-5	184-189	5	High	18	17	94%	0	0%	1	6%			Percentage of closures due to weather above the statewide average (6% to 1%)

Needs Summary Table

Performance Area	Segment Number and Mileposts (MP)				
	84/347-1	347-2	347-3	347-4	347-5
	MP 155-162	MP 162-171	MP 171-176	MP 176-184	MP 184-189
Pavement	None	Low	Low	None	Low
Bridge	None	None	None	None	None
Mobility*	None	Low	High	High	High
Safety*	None	Medium	None	Low	High
Freight*	None	None	High	High	High
Average Need	**0.00**	**0.85**	**1.54**	**1.62**	**2.23**

* Identified as Emphasis Areas for SR 347/SR 84 Corridor
# N/A indicates insufficient or no data available to determine level of need
+ A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study